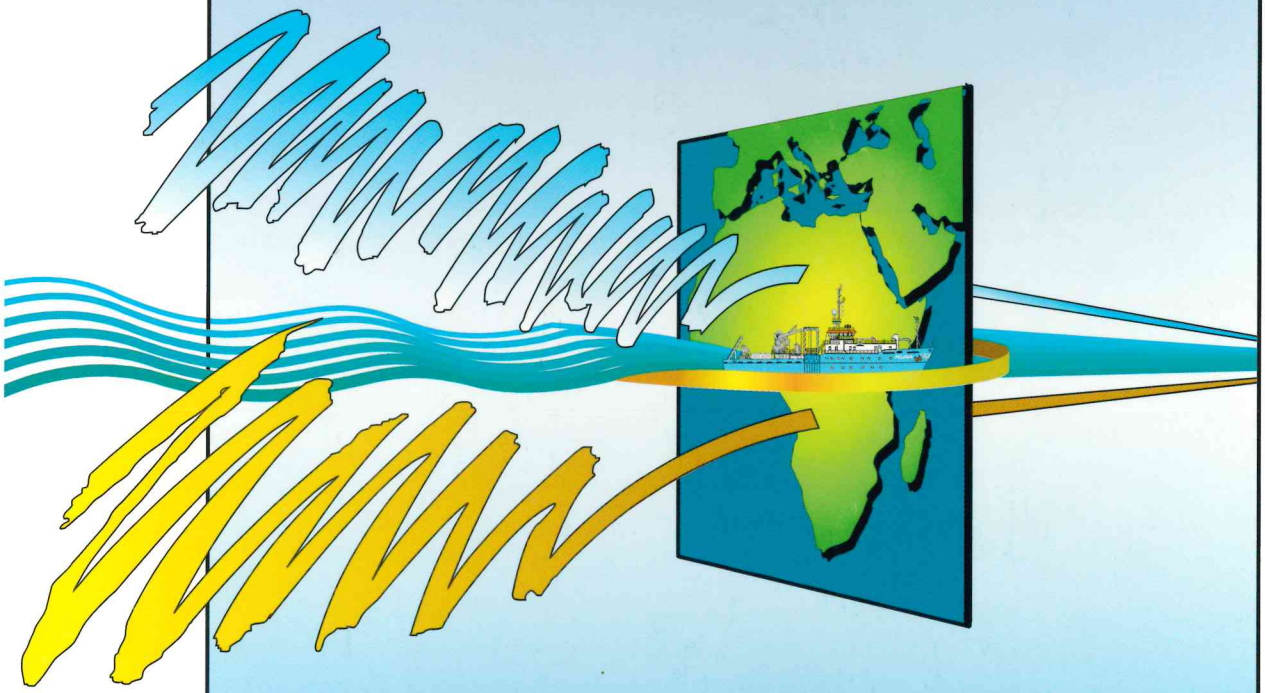
ANNUAL Report 2000



NETHERLANDS INSTITUTE FOR SEA RESEARCH (NIOZ)

NETHERLANDS INSTITUTE FOR SEA RESEARCH
ANNUAL REPORT 2000

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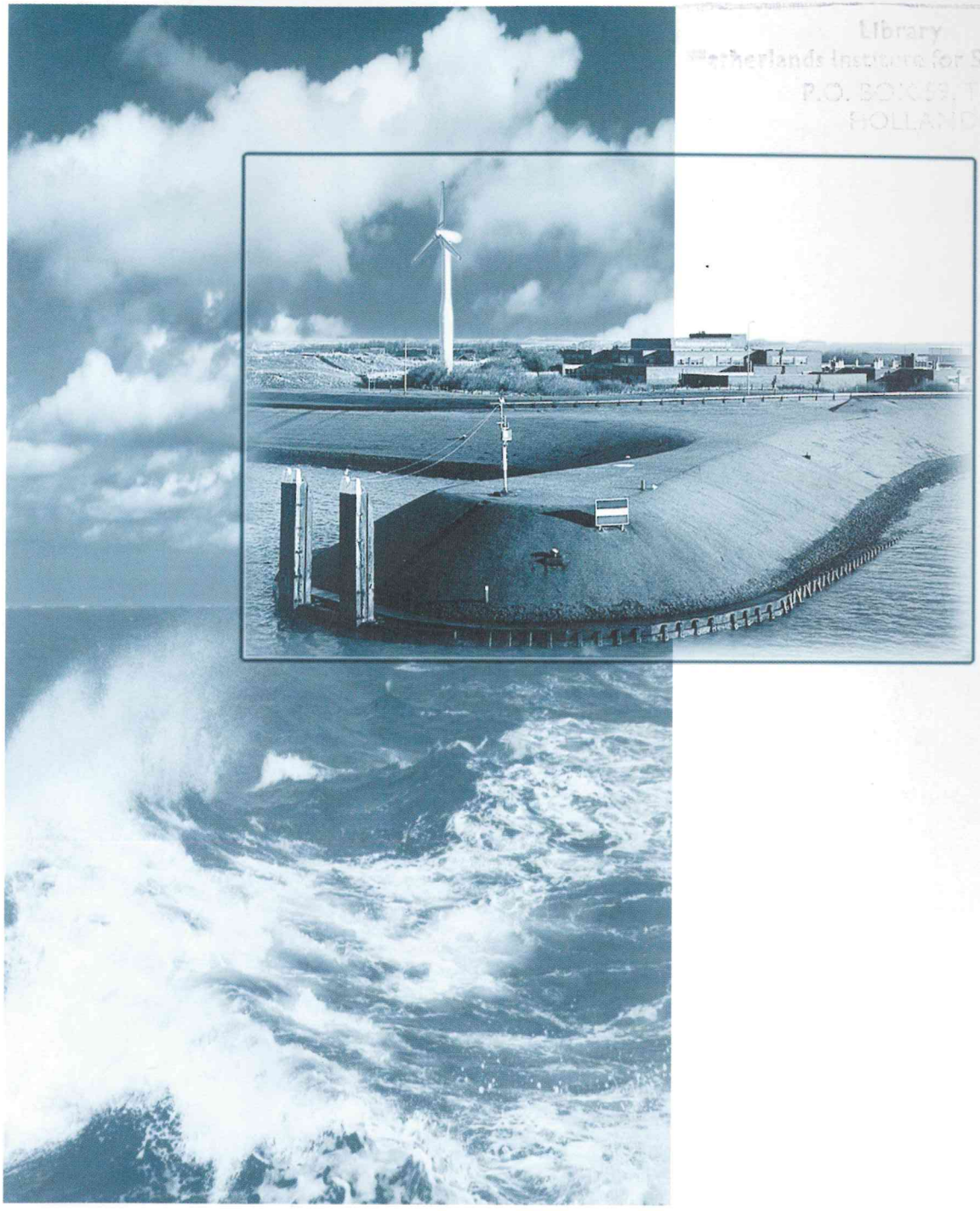


NETHERLANDS INSTITUTE FOR SEA RESEARCH

CONTENTS

INTRODUCTION 5
1. SCIENTIFIC ACTIVITY 7
AROUND AFRICA PELAGIA 2000 8
Introduction 8
MARESECS 8
MARE (Mixing of Agulhas Rings Experiment) Project 9
Agulhas Current Sources Experiment (ACSEX-1) — leg 7 11
DEPARTMENT OF PHYSICAL OCEANOGRAPHY 15
Some physics of the stratifying central North Sea 15
Physical Oceanography of the European Ocean Margin 18
External Projects of the Department of Physical Oceanography 20
DEPARTMENT OF MARINE CHEMISTRY AND GEOLOGY 21
The Ocean Margin Exchange II project (OMEX II). Dispersal and accumulation of particulate matter and organic carbon cycling in the sediments of the Iberian Margin 21
On the role of Phaeocystis sp. in the biogeochemical cycles of manganese and iron 27
External Projects of the Department of Marine Chemistry and Geology 30
DEPARTMENT OF MARINE BIOGEOCHEMISTRY AND TOXICOLOGY 31
Molecular characterization of dissolved organic matter in seawater 31
Resistant macromolecules in extant algae and ancient sediments 33
Toxicological mixture interactions between polychlorinated biphenyls and polycyclic aromatic hydrocarbons in the dab (*limanda limanda*) 35
Passive sampling of organic contaminants in water and air 37
External projects of the Department of Marine Biogeochemistry and Toxicology 40
DEPARTMENT OF BIOLOGICAL OCEANOGRAPHY 41
Production and release of the exopolysaccharide capsule of marine bacterioplankton and its bioavailability to bacterioplankton 41
External Projects of the Department of Biological Oceanography 44
DEPARTMENT OF MARINE ECOLOGY 45
Ocean Margin Exchange Program (OMEX-II-II) 45
Cockles can t stand mechanical cockle-dredging 47
External Projects of the Department of Marine Ecology 48
THE NETHERLANDS MARINE RESEARCH FACILITIES (MRF) 52
DATA MANAGEMENT GROUP 54
THE EDITORIAL OFFICE 55
2. PUBLICATIONS AND PRESENTATIONS 57
Publications 58
Dissertations 58
Refereed Papers and Books 58
Non-refereed Papers and Books 63
Internal reports 66
Cruise reports 66
Posters 67
Oral presentations 69
External professional functions 76
Meetings and Courses held at NIOZ 81
3. GUEST SCIENTISTS, VISITORS AND STUDENTS 85
Guest scientists 86
Visitors 86
Undergraduate University Students 87
4.SUPPORT SERVICE 89
5. SOCIAAL JAARVERSLAG 97
Algemeen 98
Bestuur en wetenschapcommissie 98
Organogram 99
Personeelslijst 31-12-2000 100
Arbeidsvoorwaarden 105
Verslag van de personeelsvereniging 108

During the ACSEX cruise eight ARGOS drifters, made available through a US funded global drifter program, were deployed. The drifters used were standard spherical mixed layer drifters (diameter 30 cm), fitted with a holey sock drogue at 15 m water depth. The drogues have a length of 7 m and a diameter of 1 m. The picture shows both the small surface drifter and the drogue just after deployment when the drogue still floats before it sinks to 15 m below surface.

In 2000 relatively much effort has been spent to perform the second part of our mission, i.e. education at universities and other institutes and support of high-quality marine research by initiating and facilitating sea-going research embedded in national and international programmes. For example, apart from existing academic courses two courses in marine ecology were given for future marine officers. These courses are considered very useful and may become a structural part of the curriculae of different kinds of educational institutions A new one-week course in marine biology was developed and given for biology, earth sciences and geography students, participating in the new curriculum biogeology of the University of Utrecht.

The facilitation of sea-going research was most manifest during the first five months of 2000, when the RV Pelagia performed a cruise around Africa. During 12 legs 21 different physical, biological, chemical and geological, research programs were performed by scientists and students from NIOZ, NIOO-CEMO, IMAU, KNMI, NNM, the universities of Utrecht, Nijmegen , Amsterdam (VU) and Bremen. At the end of the cruise a vivid press conference took place on board the RV Pelagia in Scheveningen harbour where the first scientific results were reported by expedition leaders and PI's.

Thanks to our excellent crew and logistic and technical staff this cruise has been very succesful, despite several severe problems encountered during the cruise, like a lightning impact, a non-performing ventilator in the engine room from Dakar to Walvis Bay and the cyclone Huddah hitting the Street of Mozambique. Also from the point of view of PR for marine research this cruise has been very fruitful through many articles in journals and magazines as well as radio interviews. Partly as a consequence of the success of this first cruise a second cruise around Africa will be performed in the first half of 2001.

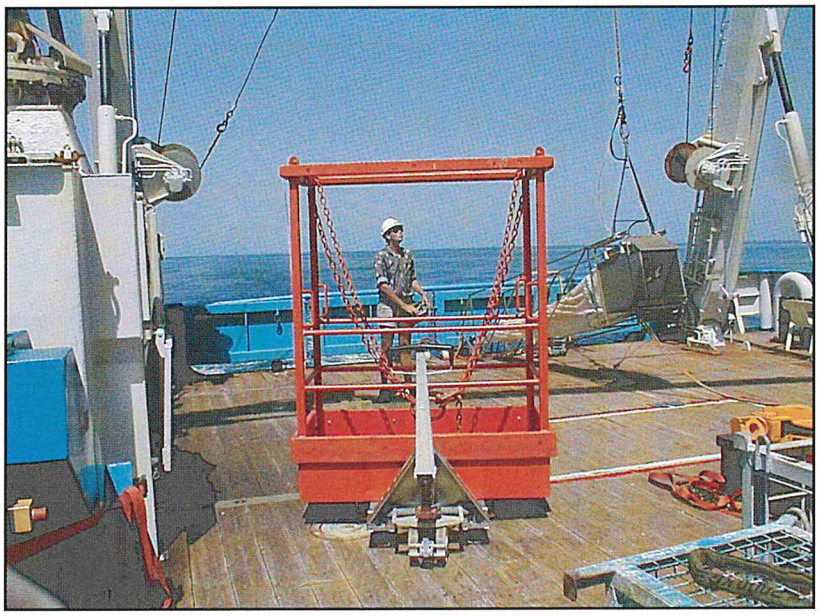
This year 10 PhD students who worked at NIOZ defended their theses, whereas the number of refereed publications was 140. It is noticed that NIOZ papers are increasingly published in first-rate journals. Two papers, dedicated to iron fertilization and sensing systems of a marine diatom, have been published in Nature and Science. Thanks to major efforts of several of our senior scientists NIOZ has been very succesful in 2000 with regard to obtaining funds in competition with others. As a consequence, NIOZ is presently participating in a large number of EU projects, a.o. dealing with methane-driven ecosystems, the role of marine viruses in the microbial food web and optimal conditions for blooming of toxic algae. After two years of existence the collaboration between NIOZ and the marine institutions at Bremen and Bremerhaven (NEBROC) has been evaluated during a workshop at Bremen. NEBROC will continue for another three years.

Despite the relatively large external funding obtained, the financial situation has remained somewhat critical, a.o. due to the general budget cut NIOZ as well as the other NWO institutes had to face despite a prosperous economy. To structurally overcome these financial constraints in the years to come much effort has been invested in the preparation and partial execution of a large pre-retirement program. As a result of this program ca. 30 employees already left or will leave our organization in the next five to seven years. This loss of employees is compensated by a large number of PhD students and post-docs joining our institute, though on a temporal base. To some extent the lack of space to accommodate our personnel is still increasing. For the greater part this problem will be solved when the new building projects that started this year will be realised. These building activities are possible only thanks to the enthusiasm and efforts of many staff members during both the preparation and the building phase.

Based on the above it is foreseen that NIOZ will start the new third millennium in a healthy mode, not only scientifically but also financially and spatially.

Jan W. de Leeuw

1. Scientific Activity



PELAGIA AROUND AFRICA

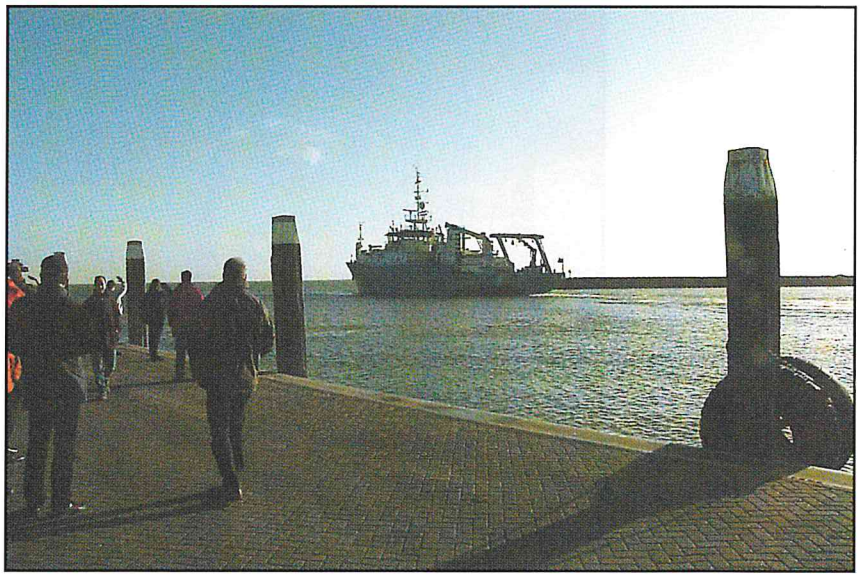
INTRODUCTION

In the millennial year, the RV Pelagia surpassed itself as a marine research platform on its voyage across the Atlantic from Texel to Cape Town and back again through the Indian Ocean and Mediterranean. During "Around Africa Pelagia-2000" no less than 21 scientific projects were carried out in a concerted national effort supported by NWO-ALW and NIOZ-MRF and a variety of other sources for the individual projects. Around Africa originated from within the MARE programme, which was founded by NWO-ALW/CLIVARNET in 1998 and required a well equiped ship for its first cruise off South Africa, preferrably in the spring of 2000. Since no such ship was available and another would be needed in the Mediterranean by early summer for the PASS2 programme supported by NWO-ALW/EU would it be feasible to combine the two in the RV Pelagia's first expedition in tropical waters? A call for proposals to carry out other research en-route resulted a third major programme, ACSEX, a combined effort of NIOZ and IMAU in the SW Indian Ocean between Mozambique and Madagascar. These three programmes provided the foundation for Around Africa Pelagia-2000 and the opportunity for a large number of smaller projects to be accomodated. On January 6th, the RV Pelagia left Texel for its 20.000 mile expedition consisting of 12 legs with participants from 13 different countries. All NIOZ departments were involved in the expedition as well as a variety of scientific disciplines from other institutions. Although lightning struck, the engine room ventilation broke down and the cyclone Hudah interferred, the RV Pelagia overcame the difficulties and arrived safely in Texel on June 7th.

MARESECS

Contributor: *G.-J.H. Brummer*

Around Africa Pelagia-2000 provided the opportunity to re-occupy the GEOSECS stations that were sampled in the 1970's to estimate reservoir inventories in the ocean basins surrounding Africa, a.o. using stable isotopes to asses the uptake of anthropogenic CO2 by the oceans carbonate system. Dissolved phase measurements will be compared with analyses of specific particles that eventually settle out and are preserved in bottom sediments. In that way, the robustness of proxies can be tested that would reflect specific ocean variables and on which paleoceanographic reconstructions are based of climate change on much longer time scales. Such consistent data bases with ocean-wide coverage are needed to validate e.g. global circulation modelling on time scales pertinent to climate change. This project was carried out in cooperation with the Alfred Wegener Institute (AWI) in Bremerhaven and the Free University in Amsterdam on legs 4, 5, 8 and 9.



RV Pelagia leaving the NIOZ-harbor on the 6th of january.
Photo: B. Aggenbach.

MARE (MIXING OF AGULHAS RINGS EXPERIMENT) PROJECT

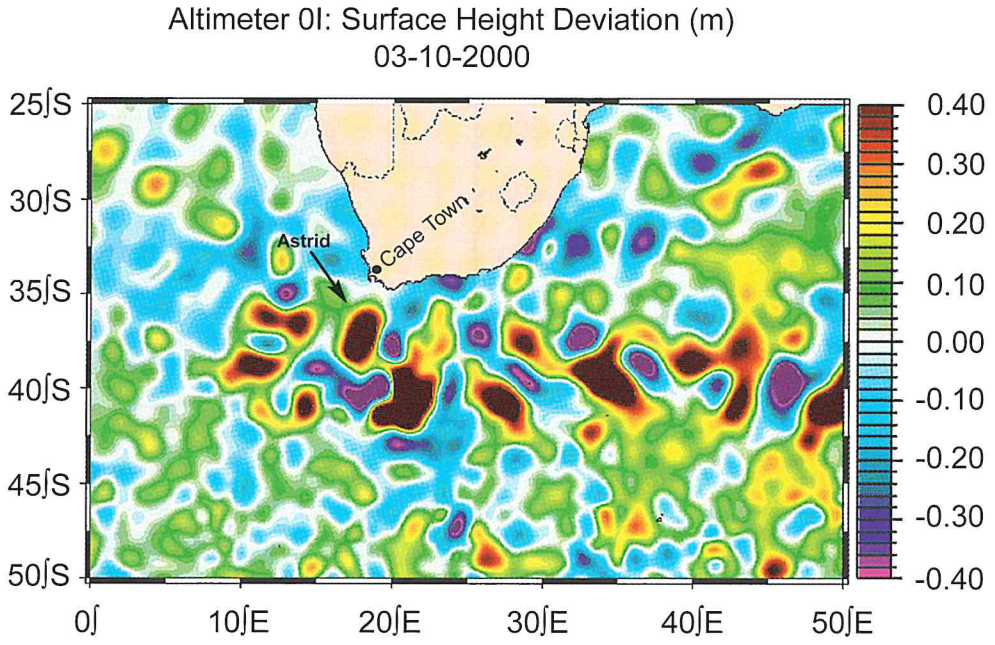
Contributors: *C. Veth, A.K. van Veldhoven, H.M. van Aken, T.F. de Bruin*

The Physical Department of NIOZ participated in the MARE-project that is one of the main components of the Dutch contribution to CLIVAR (Climate Variability and Prediction). Climate variability at interannual, decadal to millennial time scales is coupled to variations in the ocean's thermohaline circulation (THC). Interocean exchange of water (between the Indian Ocean and the South Atlantic) around South Africa is thought to be a key link in the maintenance of the THC. As a result, variability in interocean exchange induces variability in the global THC and can affect the production of North Atlantic Deep Water (NADW) and associated climate variability over Europe. Interocean exchange between the Indian Ocean and Atlantic Ocean, or Agulhas leakage, occurs on an intermittent basis. It is determined largely by the shedding of Agulhas rings which is extremely variable on an interannual time scale. As a result Agulhas rings seem to be the most likely source of South Atlantic circulation anomalies that, in the long run, influence NADW production. However, at present it is unclear what fraction of Agulhas Ring Water is transferred to the THC by mixing with the Benguela Current in the Cape Basin.

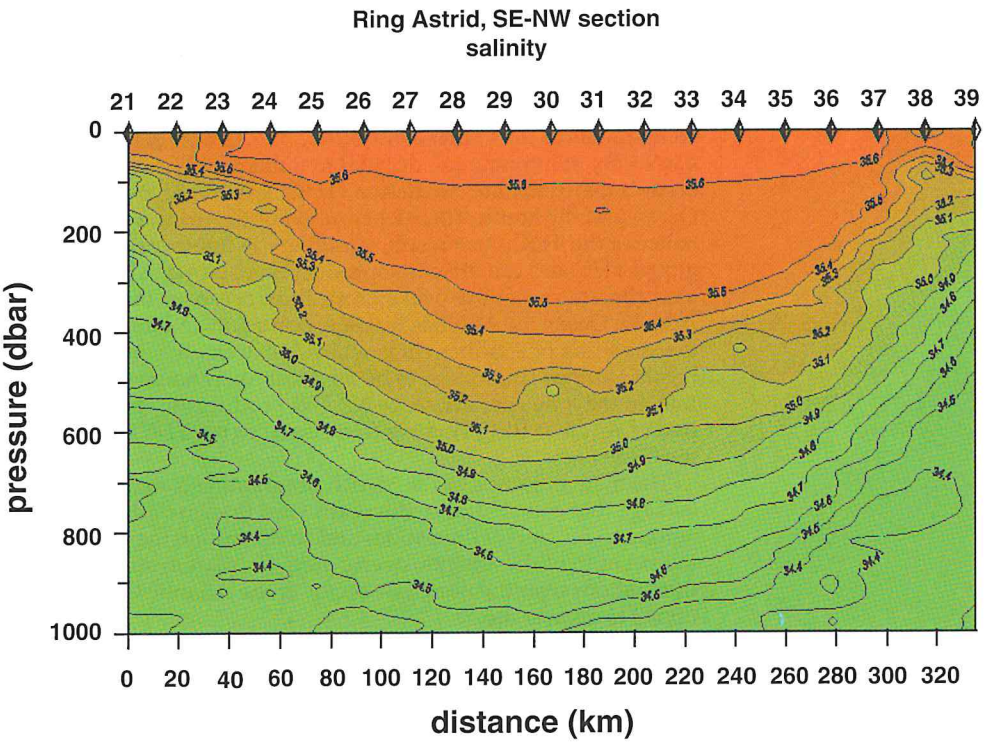
The main objective of the MARE programme is to determine the proportion of the Agulhas leakage that contributes to the northward branch of the THC, to estimate its variability at interannual to millennial time scales and to determine the impact of anomalous Agulhas leakage on the strength of the Atlantic overturning circulation and associated (actuo- and palaeo-) climate fluctuations over the northeast sector of the Atlantic Ocean. Sub-questions ('operational questions') to answer are:

- What is the decay rate of an individual ring: how fast does a ring loose its properties to the surrounding water?
- What is the relative role and magnitude of air-sea interaction in the initial stage of ring formation and in later stages?
- What is the relative role of interleaving with subsequent, vertical-shear induced turbulence and double-diffusive processes on the exchange of Agulhas ring water with its surroundings?
- What is the influence of bottom topography on the decay of Agulhas rings?

To achieve these goals, three cruises were planned of which the first two have already been carried out. During the first cruise (MARE I, March 2000), that was carried out within the framework of "Pelagia around Africa", a newly formed Agulhas ring (called "Astrid") was investigated, south of Cape Town. At this stage the ring was visible with satellite altimetry measurements (sea surface height, SSH) as well as with satellite sea surface temperature measurements (SST). The same Agulhas ring "Astrid" was investigated again during the second cruise (MARE II, July 2000) on board the South African RV Agulhas. At that time the ring was only visible using the SSH. In between the cruises the ring was tracked by satellite altimetry



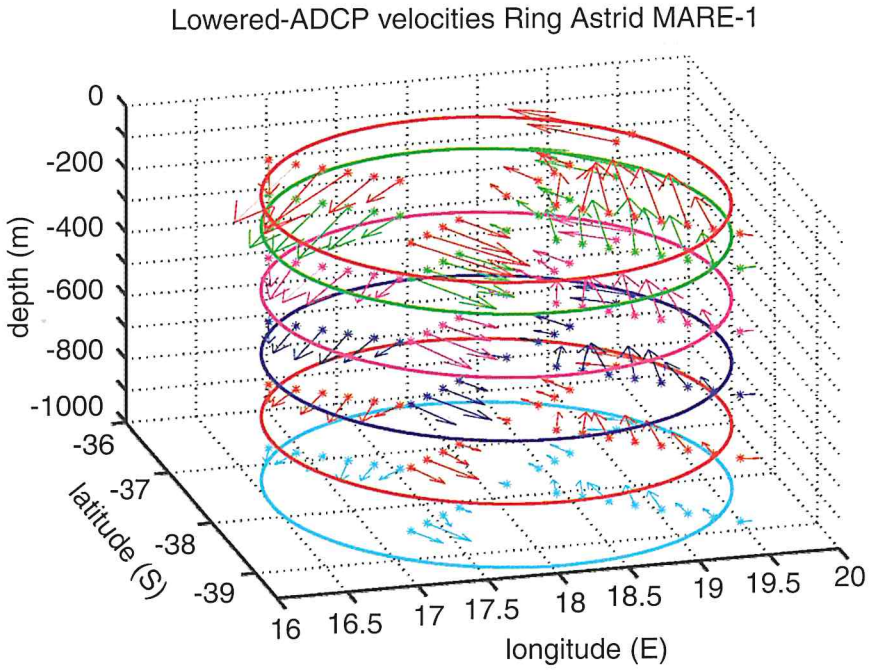
Satellite Altimeter derived sea surface height anomalies, as determined by the Naval Research Laboratory, Stennis Space Center.
Below Cape Town, the eddy "Astrid" is indicated



A salinity cross section through ring "Astrid" shortly after its formation as measured by CTD during cruise MARE-I. The contourlines present the isohalines. The marks on top are the hydrographic station numbers. Isotherms show a similar picture as the salinity section, indicating that the ring contains warmer and more saline water than the surrounding Atlantic Ocean water. The vertical structure of salinity and temperature is such, that double-diffusive processes will play an important role. The ring edges show enhanced interleaving processes caused by friction. By the erosion at the ring edge, heat and salt from the Indian Ocean is brought into the Atlantic Ocean contributing in that way to the thermohaline circulation.

and ARGOS-buoys. During both cruises the Agulhas ring was crossed a couple of times with CTD (Conductivity, Temperature, Depth) and (Lowered) ADCP (Acoustic Doppler Current Profiler) equipment, which yielded profiles and sections of temperature, salinity, potential density and the velocity components and chemical parameters from the water samples taken.

The Physical Department of NIOZ is mainly involved in the sea-going part of the project. The other participating institutes (IMAU- Utrecht, KNMI-De Bilt) emphasize the modelling and theoretical study of this subject.



The velocity field in the ring "Astrid" as measured with the lowered ADCP during the MARE-I cruise. The velocities are averaged over depth intervals of 200 m, indicated by the rings in the figure, except for the surface layer that is averaged over 100 m. The maximum velocities at the surface are of the order of 1.5 m/s. The individual discs seem to rotate almost as a rigid body with a strong velocity shear near the ring edge. Rotation of the ring is detectable as deep as the bottom at 5000 m. The velocity field measured by LADCP corresponds well with the geostrophic velocity field as determined by density sections.

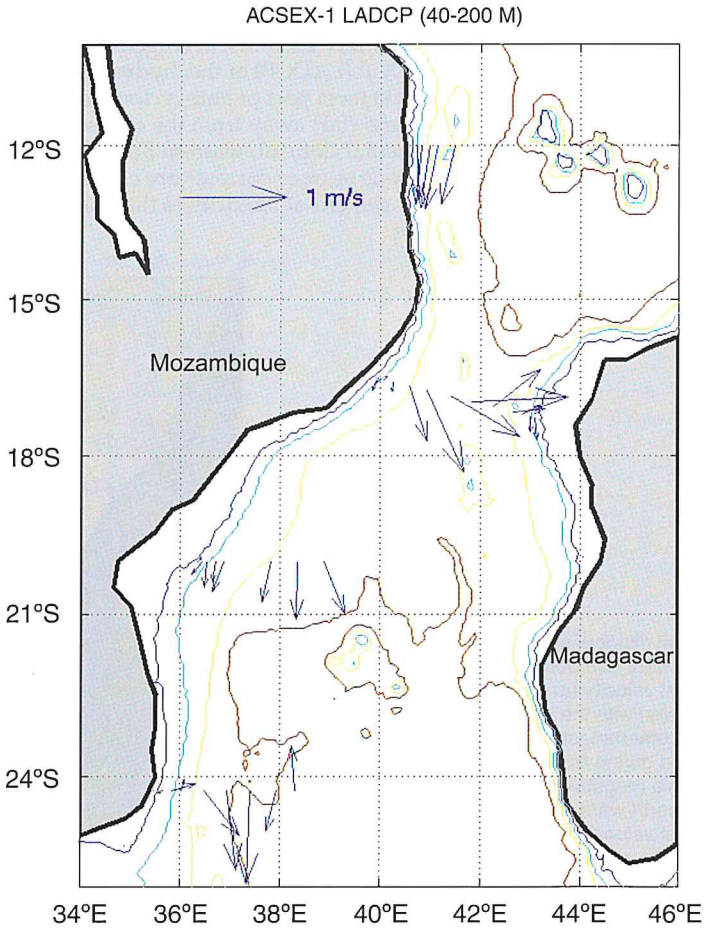
AGULHAS CURRENT SOURCES EXPERIMENT (ACSEX-1) – LEG 7

Contributors: *H. Ridderinkhof, W.P.M. de Ruijter, J.R.E. Lutjeharms*

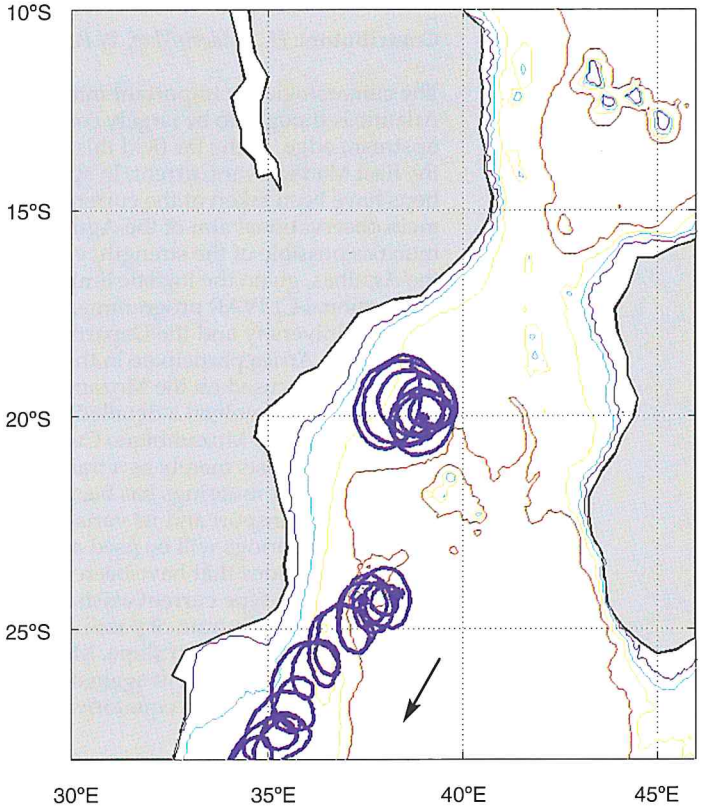
The climatologically important interbasin leakage of Indian Ocean water into the South Atlantic is thought to be largely controlled by the inflows into the Agulhas Current on its upstream edge. In the far field this inflow is fed by two sources, the Mozambique Current and the East Madagascar Current. In spite of their global significance surprisingly little observations have been taken of the currents and hydrographic structure in these source regions. The main observational aim of the Agulhas Current Sources Experiment (ACSEX) is to determine as much as possible of the strength, variability and hydrographic structure of the two sources of the Agulhas, given the logistic limitations. This research is part of the Dutch contribution to the international CLIVAR programme. The Netherlands Institute for Sea Research, IMAU of Utrecht University and the Department of Oceanography from the University of Cape town from South Africa participate in this study.

ACSEX-1 focused on the Mozambique Current in the sea area between Mozambique and Madagascar. It involved a detailed hydrographic survey in the austral summer 2000 to determine whether the Mozambique Current is a continuous, western boundary layer-type current, or whether it exists merely as a train of eddies, as altimetric data suggest. In addition, an array of current meter moorings has been placed across the narrows of the Mozambique Channel to monitor the transport and its variability over a year (2000-2001). Results from this array of current meter moorings will be used also to study internal tidal motions.

All observations that have been analysed thus far suggest that no intense, coherent western boundary layer-type current exists in the Mozambique Channel, but that the current field merely consists of a train of passing anti-cyclonic eddies that intermittently cause a net poleward flow along the shelf slope. Moreover, the observations have revealed a significant Mozambique undercurrent against the continental slope, carrying intermediate and deep waters of Atlantic origin equatorward into the Channel.

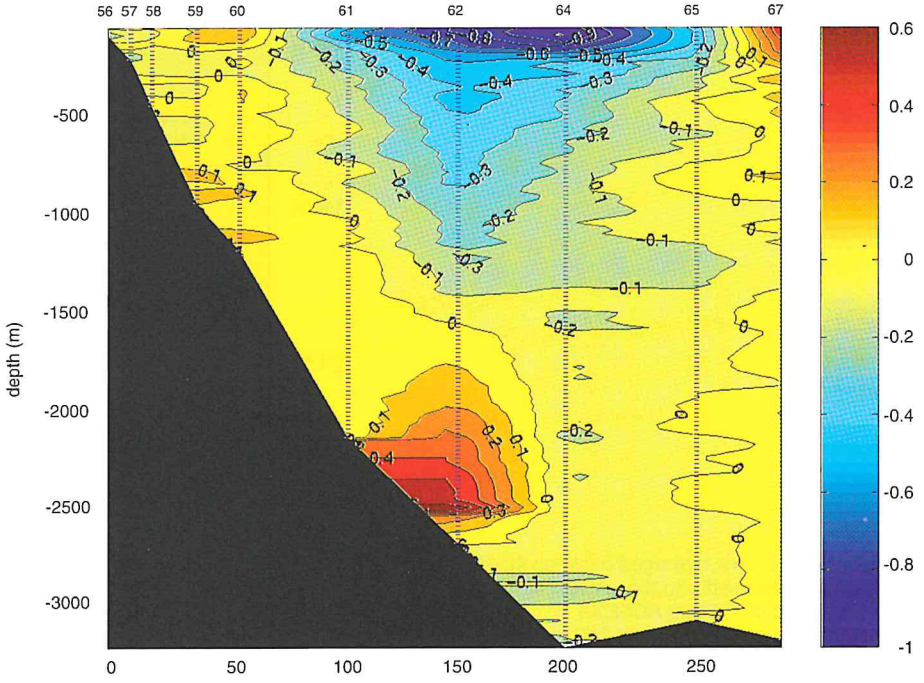


Surface current vectors, averaged between 40-200 m waterdepth, as observed with the LADCP at the hydrographic sections during ACSEX-I in Mozambique Channel. Isobaths at 200 m, 1000 m, 2000 m and 3000 m are indicated.



Movement of 2 drifters released at 24°S, and 1 drifter released at 20°S.All drifters indicate an anticyclonic movenent of the eddies. The southermost eddy propagates southward and interferes with the Agulhas current.

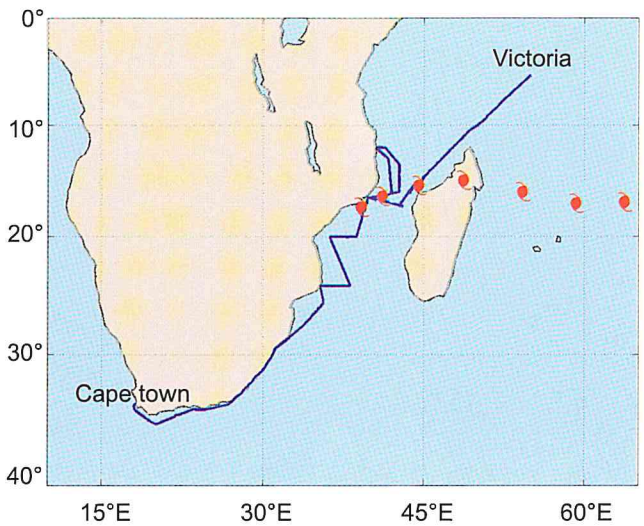
Surface currents, averaged between 40 – 200 m waterdepth, as observed with the Lowered ADCP (LADCP) at the hydrographic sections illustrate that relatively strong currents of O(1 m/s) form part of anti-cyclonic eddies in Mozambique Channel. The strongest currents are found (far) away from the continental slope, above the deep part of the Channel. Near the continental slope no western boundary layer-type current was found. The suggestion that these strong surface currents are caused by the presence of anti-cyclonic eddies is confirmed by the movement of the drifters that have been deployed during the cruise. The eddies penetrate all the



Vertical distribution of the north-ward component of the current velocity (m s^{-1}) as observed with the LADCP at the southernmost hydrographic section during ACSEX-1. Positive (negative) values indicate north-ward (south-ward) current velocities. Numbers on top and vertical dashed lines indicate hydrographic stations.

way to the bottom where swirl velocities are still around 0.10 m/s. These eddies propagate more or less through the centre of the Channel and produce an intermittent southward current at the Mozambique side and a northward current on the Madagascar side. The eddies carry very salty (and warm) tropical upper layer and thermocline water southward. In their cores, at intermediate level, they contain relatively salty, low oxygen, Red Sea Water (RSW). At the same intermediate depth level, between 1000 and 1500 m depth, the undercurrent core, hugging the Mozambique continental slope, carries Antarctic Intermediate Water (AAIW) northwards. Results from the other hydrographic sections show that strong isopycnal mixing occurs between the AAIW and RSW in the Channel, northwards of this section. A very strong deep western boundary current is encountered at a depth of around 2500 m. Its core has a speed of over 60 cm.s^{-1}. This jet carries North Atlantic Deep Water northwards.

In summary, all preliminary results available from this cruise led to the conclusion that a coherent and persistent Mozambique Current along the shelf edge off Mozambique does not exist. Instead, the observed regular train of anti-cyclonic Mozambique Channel eddies might form a significant link in the global ocean circulation system.



In early 2000 an extremely high number of tropical cyclones developed above the Southern Indian Ocean. One of these, *Hudah*, crossed the planned cruise track of RV Pelagia during the ACSEX cruise. Therefore the hydrographic survey of the main section where the deployment of an array of current meter moorings was planned, was interrupted. In order to hide for *Hudah*, RV Pelagia sailed in a north-westerly direction, roughly 300 nm to the north of the main section. After Hudah had passed the main section, RV Pelagia sailed back to the research area at a safe position relative to Hudah (roughly 250 nm to the north – east of the cyclone). The map shows the track of RV Pelagia and the daily position of the tropical cyclone.

The photo shows the severe weather associated with Hudah from some distance.
Photo: H. Ridderinkhof.

DEPARTMENT OF PHYSICAL OCEANOGRAPHY

Scientific efforts within the department of Physical Oceanography (FYS) were organized under the following themes:

1. Ocean circulation and hydrography
2. Processes near continental slopes, internal waves and mixing
3. Tides and morphodynamics of coastal zones

The first theme has a strong emphasis on subjects relevant to climate, thereby focusing on large-scale circulation and hydrography. Seagoing ocean research is a major component of this theme. Results from the Bay of Biscay programme, with yearly cruises between 1995 and 1998 in the framework of the WOCE Hydrographic Programme, are presented in more detail below. Presently, research programmes are carried out as part of the international programme CLIVAR. As a follow up of former WOCE activitities in the North Atlantic a hydrographic repeat-survey of the section between Ireland and Greenland was undertaken. A large study with expeditions in the Southern Atlantic and Indian Ocean focussed on 1) the role of Agulhas rings in the exchange between both oceans (MARE) and 2) the sources of the Agulhas current (ACSEX). Both studies are performed in close collaboration with IMAU (Utrecht University), KNMI (Institute for Meteorology, de Bilt) and UCT (University of Cape Town), and will be continued in 2001.

The second theme deals with theoretical, laboratory and observational studies of the interaction between internal waves in a stratified ocean and topography. Results from detailed observations on internal waves in the stratified North Sea are presented below. Observations from both laboratory experiments and seagoing programmes (e.g. the multidisciplinary programme Processes near Continental Slopes (PROCS), together with MCG and MEE) were analyzed, with main emphasis on the propagation and geometric focussing of internal waves. First results indicated that spatial variations in sedimentological and biological parameters are related to the intensity of internal waves. A numerical model has been developed that is used for further interpretation and analysis of the PROCS field data but also of similar data, e.g. those obtained in the Mozambique Channel as a part of ACSEX.

The third theme consists of studies in the shallow coastal zone. One of the objects of study is the transport and exchange of suspended material between the coastal zone and shallow tidal basins using both field observations and numerical modelling. This study is part of a large research programme on the morphological development of outer tidal deltas funded by ALW/NWO and in which different Dutch universities and institutes collaborate. A detailed analysis of ferry-data on currents and suspended sediments in the Marsdiep inlet forms an important part of this research programme. In a theoretical study, supported by laboratory experiments, non-linear aspects of tidal motions in coastal embayments are being studied.

Activities outside the main themes were the development of the physical part of multidisciplinary models and the application of marine optics in oceanography, carried out in collaboration with other departments and/or institutes. Furthermore, the department supported national seagoing research programmes with hydrographic observations, satellite data and overall data-management. For these national tasks the Data Management Group acts as a separate group within the department.

SOME PHYSICS OF THE STRATIFYING CENTRAL NORTH SEA

Contributor: *Hans van Haren*

In the early 1980's, the central North Sea received substantial Dutch scientific interest. Main focus was put on the characteristics of the water column above featureless topography: its strong, seasonally varying vertical temperature difference or 'thermal stratification'. The study resulted in a concise mapping of the summer stratification, its onset in spring and breakdown in autumn and its relationship with observed current and phytoplankton distributions. About a decade later, renewed interest in the impact of physical processes on biomass distributions resulted in the initiative of the Integrated North Sea Program (INP), with the aim to establish the dominant process of mixing across enhanced stratification through observations and numerical modeling. Novel instrumentation was acquired to estimate in-situ fluorescence and nutrients. An Acoustic Doppler Current Profiler (ADCP) was used to resolve details of vertical current variations. These and other instruments allowed better observations during longer periods, the final measurement campaign lasting 15 consecutive months including one rough winter and a very calm and warm summer.

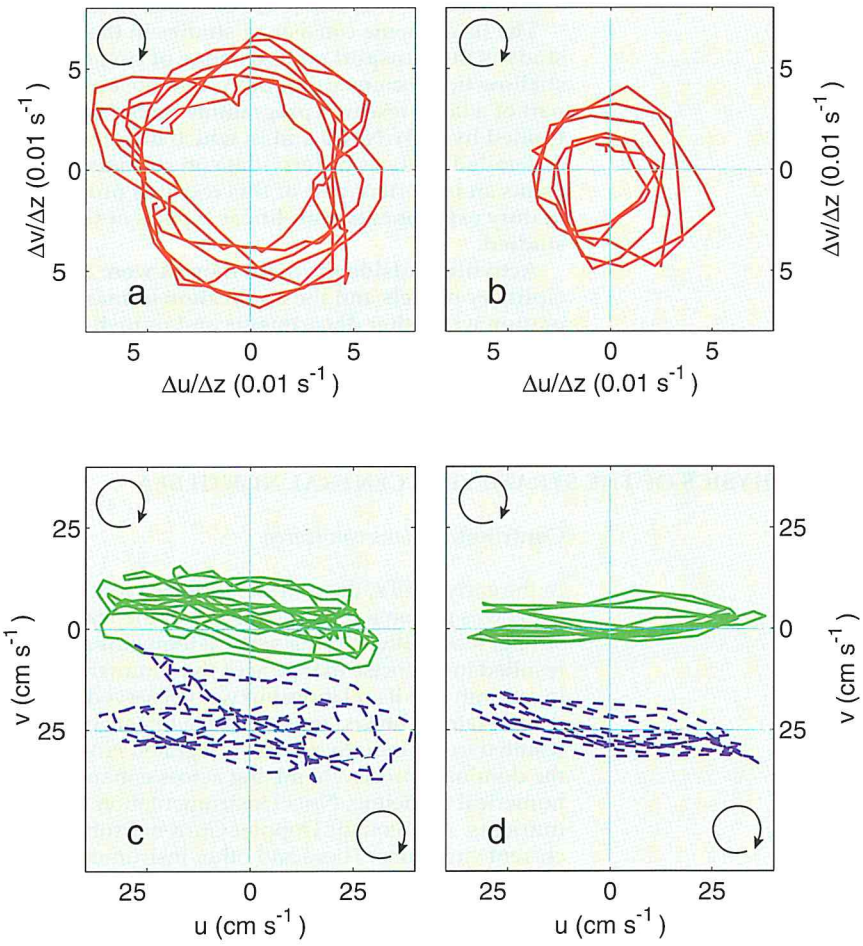
In 45 m deep Oyster Grounds in the central North Sea, currents are dominated by those oscillating at semidiurnal tidal frequencies. When stratification develops in spring, these currents

Dynamical marginal stability

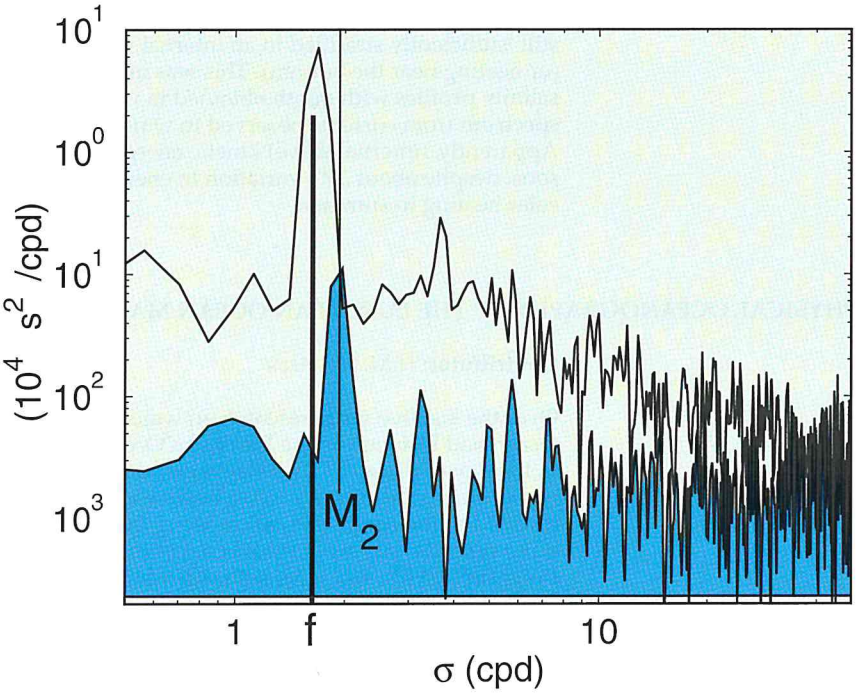
Density differences in the central North Sea are largely due to temperature differences, warmer water being lighter than cold water. Solar heating from above stratifies the water column in density, thereby stabilizing it and suppressing vertical exchange. Near-surface wind and near-bottom tidal friction tend to mix the initial stable stratification from above and below, respectively, so that it becomes concentrated in a thin layer ('thermocline'). The resulting stratification shows enhanced static stability. It also supports 'internal' gravity waves, which range from relatively slow near-'inertial' waves, at frequencies related to the vertical component of the earth's rotation vector, to small-scale high-frequency waves, which depend on the vertical density gradient. The lowest frequency internal waves cause the largest vertical current differences ('shear') across stratification. This shear de-stabilizes the water column at the depth of the thermocline and may cause mixing through the breaking of the high-frequency internal waves. This reduces stratification so that it finally presents a delicate balance between stratifying and destratifying agents: a critical or dynamical marginally stable state.

become strongly vertically modified. Extensive analysis has shown that this modification is not due to 'internal tidal wave' motion supported by summer stratification. Such internal tidal currents are not dominant in the central North Sea, but tidal currents do have a peculiar relation with stratification due to variations in friction in the water column, which depend on stratification.

The anticyclonic (clockwise) circular component of semidiurnal tidal currents determines the height over which the near-bottom layer is mixed. Above this, a layer of enhanced stratification develops, hampering this current component by reducing the turbulent transport of momentum across it. However, this rapid attenuation of the currents with increasing height implies an increase of shear of the same current component, which, paradoxically, weakens the stability.



Observed shear (a, b) and current (c, d) ellipses across strong stratification from hourly sub-sampled, but not band-pass filtered data observed in the Oyster Grounds. The arrows indicate the sense of rotation. Shear is indicated by finite current difference components (Δu/Δz, Δv/Δz). It is seen that shear is always circularly polarized, whether dominantly inertial (a) or tidal (b). In both cases, the corresponding current ellipses above (solid line) and below stratification (offset; dashed line) are more or less rectilinearly polarized. Panel c shows currents used to construct shear in (a), and similar for (d) related to (b).



Shear spectra obtained by finite differencing current observations in the Oyster Grounds over 0.5 m intervals in a strong summertime stratification at 13 m depth where inertial (f) shear dominates (solid line) and, for comparison, at 40 m depth (5 m from the bottom), where tidal (M_2) friction dominates (shaded). Note that the two spectra are not offset deliberately.

This phenomenon is more pronounced when such tidal shear is accompanied by internal 'inertial shear'. The latter is induced by moving atmospheric disturbances or by adjustment under gravity (restratification) of fronts (especially also under calm weather conditions), thereby causing anticyclonic circular motions due to Coriolis forces. Because this shear is highest across strongest stratification, the water column maintains a condition of 'dynamical marginal stability' when strong stabilizing stratification supports strong de-stabilizing shear. Observations demonstrated that the condition of dynamical marginal stability is quite persistent in time.

Under marginal stability, atmospheric and tidal friction cannot mix material across a thermocline that prevents that the two frictional layers overlap. However, such condition provides an internal condition for mixing through the breaking of small-scale internal waves. Observations suggest that the latter be generated after multiple interactions between components of inertial and tidal currents, which determine the energy level of the entire internal wave band and turbulent transport across the stratification. This transport is sufficient to explain summer-time increase of temperature in the bottom boundary layer with horizontal advection playing a minor role only. It is also sufficient to explain the mid-summer increase of nutrients near the surface following regeneration at the bottom and triggering a phytoplankton bloom in late-summer well before the autumnal breakdown of stratification.

Concurrent temperature and chlorophyll observations also showed the need of turbulent mixing for the development of a phytoplankton bloom in spring, which consisted mainly of relatively large diatoms. This may explain the abundance of such phytoplankton species in areas like the central North Sea, where sufficient turbulence ensures cycling between nutrient-rich near-bottom- and light-abundant near-surface layers. The spring bloom ceased as soon as thermal stratification increased above measurable levels, with no indication found for vertical phytoplankton (and/or salinity) gradients triggering the onset of thermal stratification at the INP

Oscillatory currents and circular shear

On a rotating earth, an oscillatory horizontal current is deflected due to the Coriolis force so that it describes an ellipsoidal path. Such ellipsoidal motion may be decomposed into two counter-rotating circular motions. When the motions are strictly back and forth ('rectilinear' or 'degenerated ellipse'), such as for the semidiurnal tidal current observed in the Oyster Grounds, the two circular motions have equal amplitudes. Inertial oscillations cannot support a cyclonic (anti-clockwise) component and therefore describe a circular path. Frictional decay of oscillatory motions away from the bottom is best explained from its different effects on the two circular motions. The cyclonic component shear is attenuated most. As a result, any oscillatory current shear well away from the bottom is (anticyclonic) circular, regardless the original ellipticity of the currents. In this manner, tidal friction determines the height above the bottom of the layer of enhanced stratification and the persistence with time of a possible dynamical marginally stable state.

mooring location in the Oyster Grounds as has been suggested for other sea areas. It was concluded that such triggering is not necessary as a homogeneous ('well-mixed') water column is still 'sufficiently stratified in an internal wave sense' in the absence of cooling near the surface (or heating near the bottom). This was inferred from direct observations of temperature and salinity profiles with depth obtained in winter and by the robust shape of the internal wave spectrum from currents observed in winter compared with those observed in summer. Apparently, (internal wave) kinetic energy remains the same (within 5%) throughout the seasons, despite about 25% variation in energy input due to enhanced wind stress in winter and solar heating in summer.

PHYSICAL OCEANOGRAPHY OF THE EUROPEAN OCEAN MARGIN

Contributor: *H.M. van Aken*

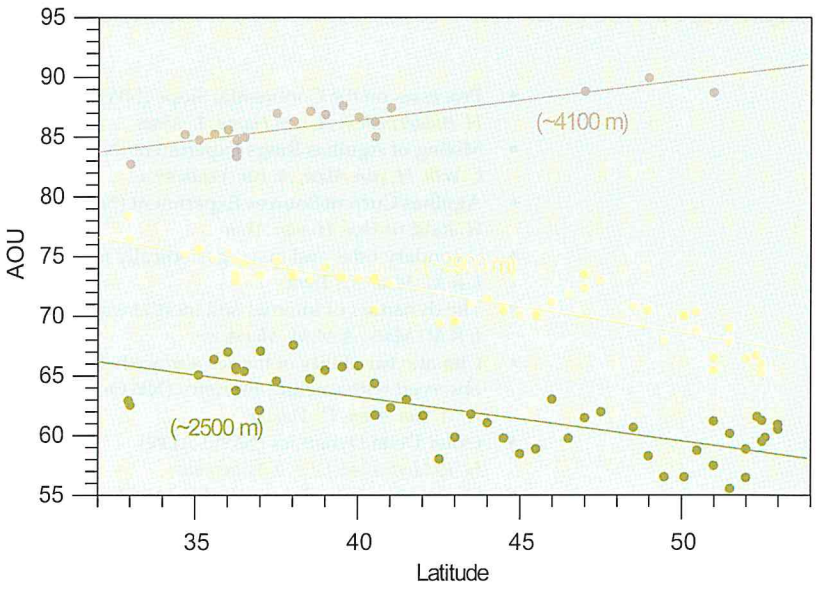
Over the last five years research on water circulation and hydrography of the North-Atlantic Ocean had its focus on the European Ocean Margin. While in 1992 and 1993 preliminary cruises in the Bay of Biscay of RV Pelagia had their main emphasis on internal waves near the continental slope, the annual cruises between 1995 and 1998 during the TripleB programme were directed to the ocean circulation along the ocean margin. The hydrographic data obtained on these repeated surveys formed part of the Dutch contribution to the WOCE Hydrographic Program (WHP), and were submitted to the WHP Data Assimilation Centre. These data also formed the core of the data used for the study of the hydrography of the European Ocean Margin within the framework of the EC funded OMEX programme. OMEX aimed at the study of the exchange of organic matter from the European continental shelf to the deep sea. The data obtained during TripleB and OMEX were extended with other WHP data, and data available at the ICES hydrographic data base. A total of approximately 2200 hydrographic stations became available, with observations of temperature, salinity, dissolved oxygen and inorganic nutrients. With these data, descriptions on the water mass structure in the deep and intermediate layers, as well as in the permanent thermocline of the Northeast Atlantic have been produced. In addition 24 surface drifters, deployed from 1995 to 1998 during the TripleB programme, have been used for the description of the surface circulation in the Bay of Biscay.

Hydrography of the eastern North Atlantic

Data on temperature, salinity and pre-formed nutrients were used to allow a quantitative description of the deep water masses, especially the Northeast Atlantic Deep Water, in terms of source water types. Over the Porcupine Abyssal Plain, between 2500 and 2900 dbar, Northeast Atlantic Deep Water appears to be a mixture of mainly Iceland-Scotland Overflow Water and Labrador Sea Water (~80%), with minor contributions of Lower Deep Water and Mediterranean Sea Water. When the Northeast Atlantic Deep Water flows southwards towards the Madeira Abyssal Plain, contributions of the former two water types of northern origin diminish to about 50% due to diapycnal mixing with the overlying and underlying water masses. At deeper levels (~4100 dbar), where the nutrient rich Lower Deep Water is found near the bottom, the meridional gradients of oxygen and nutrients are opposite to those found between 2500 and 2900 dbar. Diapycnal mixing cannot explain this change in gradients, which is therefore considered as a qualitative indication of ageing of the Lower Deep Water when it flows northwards.

The presence of intermediate water masses causes alternating maxima and minima in the distribution of salinity along the ocean margin. While near the Porcupine Sea Bight the sub-surface salinity minima are connected with the presence of Sub-Arctic Intermediate Water, in the Gulf of Cadiz and along Northwest Africa remnants of Antarctic Intermediate Water are connected with these minima. Off the Iberian Peninsula these minima represent a water mass, formed by winter convection in the Porcupine Sea Bight and the northern Bay of Biscay. The core of Antarctic Intermediate Water appears to contribute to the formation of Mediterranean Sea Outflow Water since it becomes entrained into the overflow near Gibraltar. This entrainment gives rise to an enhanced concentration of the nutrients in the Mediterranean water in the North Atlantic. At all intermediate levels, the continental slope in the Bay of Biscay seems to be a focal point for water mass modification by diapycnal mixing.

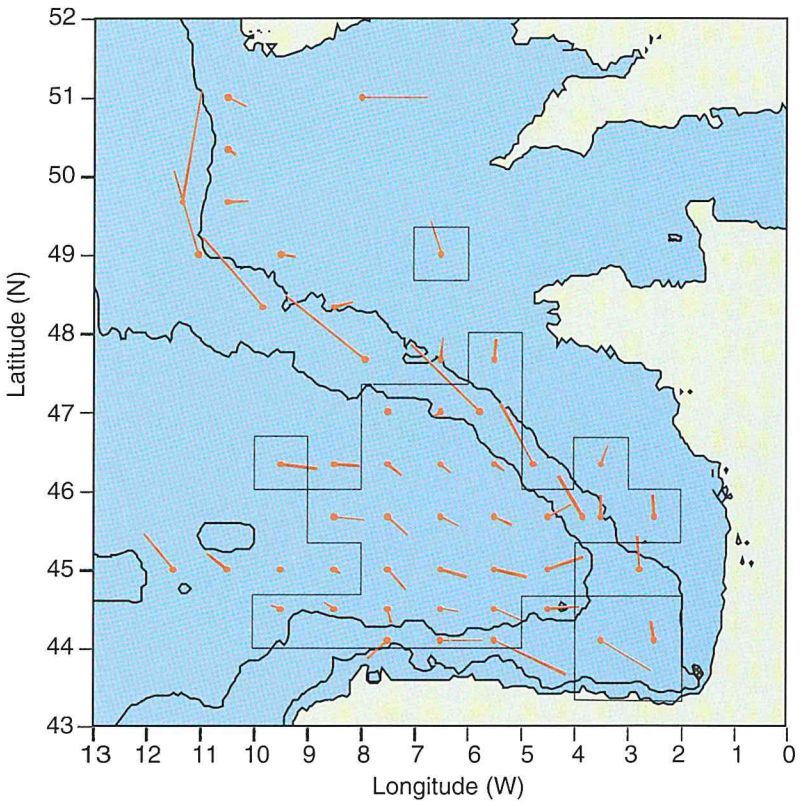
The Eastern North Atlantic Central Water in the permanent thermocline has been described by means of conservative tracer distributions and the distributions of the non-conservative tracers like apparent oxygen utilization and dissolved nutrients. The resulting hydrographic structure agrees with ventilation of the thermocline by southwards subducted mode water from the eastern North Atlantic. Along the west Iberian continental slope the diapycnal mixing coefficient, derived from the salinity distribution, is high ($O(10^{-3}$ $m^2s^{-1})$) From the observed meridional ageing trend a characteristic southward velocity of -1 cm/s and a total subduction of 4.5 Sv between 32 and 52°N east of 20°W have been estimated.



The meridional distribution of the Apparent Oxygen Utilization (AOU μmol/kg) near 20°W. in isopycnal surfaces in the cores of Lower Deep Water (~4100 m) and Northeast Atlantic Deep Water (~2500 to 2900 m). The southward AOU increase between 2500 and 2900 m agrees with ageing due to mineralization of organic matter in the southward flowing core of Northeast Atlantic Deep Water. The reversed gradient at ~4100 m is indicative of the ageing during the pole-ward flow of Lower Deep Water.

Surface circulation in the Bay of Biscay

The tracks of 25 surface drifters from the Bay of Biscay have been analyzed for high-frequency tidal and inertial motions, meso-scale eddy motion and seasonal-mean advective currents. The kinetic energy of the high-frequency tidal and inertial surface currents over the abyssal plain appears to be so high that internal tidal waves are required as an explanation. The relatively weak eddy kinetic energy shows a seasonal cycle in agreement with the idea of generation of eddies in winter at the seasonal, pole-ward slope current. The rotation sense of the eddies is dominantly anti-cyclonic, while both cyclonic and anti-cyclonic eddies are characterized by a local vorticity of several tenths of the global vorticity. The large-scale advective mean flow shows a clear seasonal cycle with a broad southward flow in summer and a narrow pole-ward slope current in winter, fed by an eastward flow over the abyssal plain.



The mean surface current in winter (October to April) derived from the tracks of surface drifters deployed from 1995 to 1998. Only vectors based on over 20 drifter days are shown. The boxes indicate the area where over 40 drifter days per $1^{\circ}2/3^{\circ}$ box are available. The evident pole-ward slope-current between the 200 and 4000 m isobaths (the thin lines) is absent in the summer months.

EXTERNAL PROJECTS OF THE DEPARTMENT OF PHYSICAL OCEANOGRAPHY

- Processes on the Continental Slope (NWO-ALW)
  H. Ridderinkhof, H. van Haren, L. Maas
- Mixing of Agulhas Rings Experiment (NWO-ALW)
  C.Veth, H. van Aken, A. van Veldhoven
- Agulhas Current Sources Experiment (NWO-ALW)
  H. Ridderinkhof, H. van Aken
- Secondary tides and quasi-periodically forced nonlinear oscillators (NWO-FOM)
  L.R.M. Maas, G. Terra
- The dynamics of internal and inertial waves in enclosed basins (NWO-NLS)
  L.R.M. Maas, A.M.M. Manders
- Climatic variability of the sea surface height and circulation in the northern North Atlantic Ocean observed with satellite altimetry (NWO-SRON)
  H.M. van Aken, D. Volkov
- Outer Delta Dynamics (NWO-ALW)
  H. Ridderinkhof, J.T.F. Zimmerman
- Ocean Margin Exchanges II (EC-MAST)
  H.M. van Aken, M.A. Hiehle, R.X. de Koster
- Processes of Vertical Exchange in Shelf Seas (EC-MAST)
  H. van Haren, J. Gemmrich, M.T.J. Hillebrand
- Coastal region long-term measurements for colour remote sensing development and validation (EC-MAST)
  M.Wernand
- Monitoring coastal color and suspended solids in nature (Rijkswaterstaat)
  M.Wernand, M. Regeling
- Volvo Ocean Color (Volvo car corporation, Sweden)
  M.Wernand

DEPARTMENT OF MARINE CHEMISTRY AND GEOLOGY

The department is involved in marine research covering the processes associated with production of biogenic material in the (euphotic) water column, its settling to the seafloor, its transformations during early diagenesis and its incorporation into the sediments. The efforts are carried out in four themes:
Within the theme *'Carbon and trace metals in the oceanic water column'* the department focuses on the chemical processes in the euphotic water column that influence the biological cycle of photosynthesis and respiration of organic matter. Major emphasis is on the role of nutrients, including iron and other trace metals, in the production of organic matter and on air-sea exchange of carbondioxide, both directly linked to global carbon cycling. In 2000, efforts concentrated on an *in-situ* iron fertilization experiment on board R/V Polarstern to stimulate CO_2 fixation in the Southern Ocean, air-sea exchange and meridional transport of CO_2 in the North Atlantic, and on the uptake anthropogenic CO_2 by the global ocean. For the latter, we used both a modeling approach and an experimental approach in which we resampled the former GEOSECS stations off the African continent.

The objectives of second theme *'Sedimentation and sediment transport processes'* are to link export fluxes of organic matter from the euphotic water column with deposition fluxes on the seafloor, and to unravel the complex of sedimentological processes that have determined continental margin buildup as a function of past oceanographic and climate conditions. Major studies concerned the cross-slope zonation of erosion and deposition due to internal wave activity in the Faeroe-Shetland Channel, the stratigraphy of glaciated European margin sediments, the processes responsible for the occurrence and distribution of cold water coral communities and carbonate mounds, and the sedimentology on the continental slope of the Iberian Margin.

In the third theme, *'Early diagenetic processes'*, research questions are directed to the factors that control the ratio between, on the one hand, mineralization and reflux to the water column and, on the other hand, burial of organic matter and associated elements in the sediment. This ratio determines how much of the biogenic compounds is lost from the global ocean on longer time scales, and also whether depositional signals in the sedimentary record can be used as indicators for past water column processes such as palaeo-primary-production. This year, work focused on the quantification of mineralization and burial of organic and inorganic carbon in sediments of the Iberian Margin, the role of iron and manganese in benthic redox cycles, the preservation and mineralization of amino acids in oceanic sediments, and on the dissolution and preservation of biogenic silica in sediments in the western Indian Ocean.

The theme *'Palaeoceanography'* concentrates on past oceanic processes using parameters that have been preserved in the sedimentary record at time scales from decades to centuries, to thousands and even millions of years. Major effort was put into studying the imprint of variations of Agulhas ring transports from the Indian into the Atlantic Ocean in the sedimentary record off southern Africa, and in the application of proxies for palaeoclimate reconstructions.

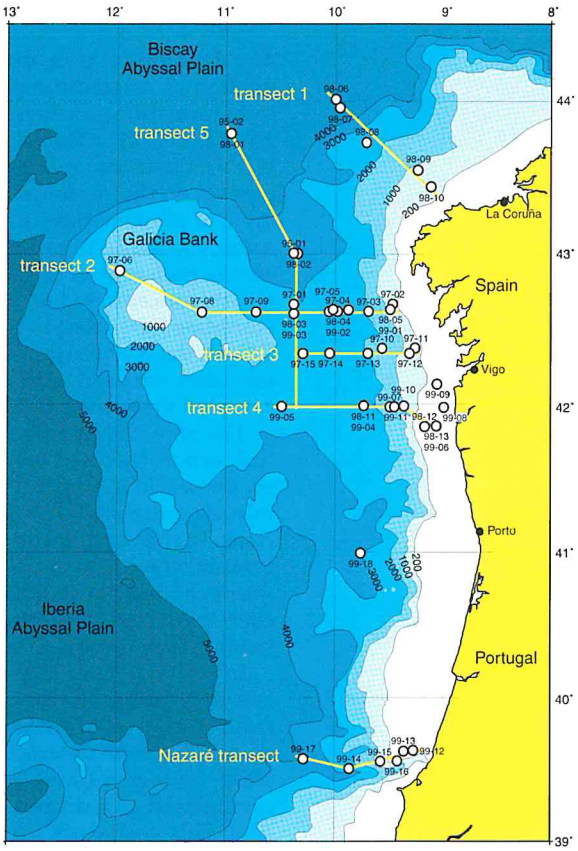
THE OCEAN MARGIN EXCHANGE II PROJECT (OMEX II). DISPERSAL AND ACCUMULATION OF PARTICULATE MATTER AND ORGANIC CARBON CYCLING IN THE SEDIMENTS OF THE IBERIAN MARGIN.

Contributors: *Eric Epping, Henko de Stigter, Tjeerd van Weering, Willem Helder, Claar van der Zee*

The research described here concentrated on the dispersal and accumulation of particulate matter and benthic recycling and long-term burial of organic carbon in the sediment. Sample material for this study was obtained during three cruises with RV "Pelagia" to the NW Iberian margin, in July 1997, August 1998 and May 1999. CTD profiles and water column samples were collected at 31 stations, box cores and/or multi cores at 37 stations and piston cores at 17 stations. In situ observations on near bed dynamics were made during long term deployments with the BOBO lander. In situ oxygen microprofiles and sediment-water fluxes of solutes were collected with the TROL lander.

Morphology and sediment distribution

On the northwestern extreme of the Iberian peninsula, the rugged mountainous coast of Galicia, deeply indented by large embayments, is facing the Atlantic Ocean. The Portuguese coast further to the south has a more gentle appearance with low hills and a straight coastline. A number of rivers, of which the Douro is the most important, debouch into the northern Portuguese shelf sea.



Sampling stations and transects sampled during the OMEX-II project.

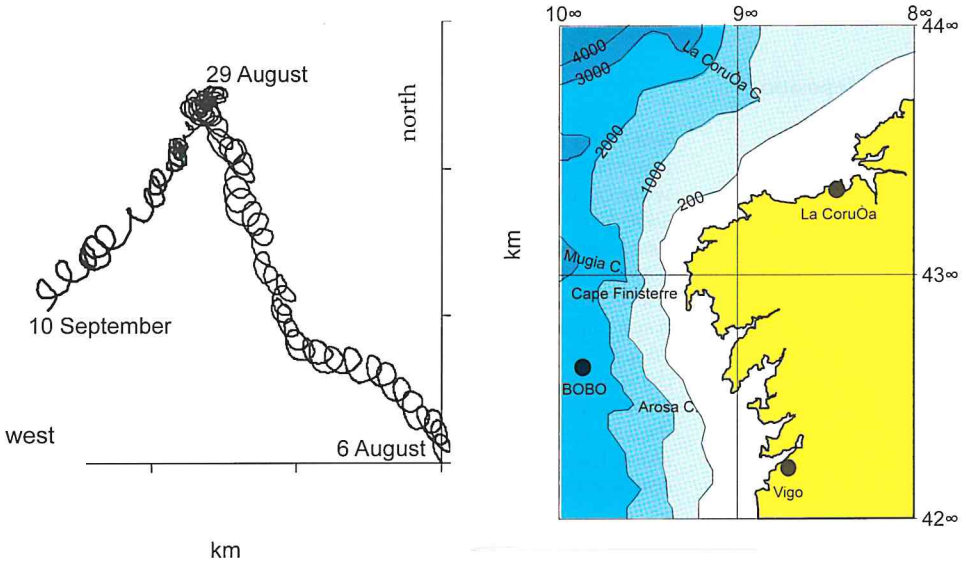
The Galician and northern Portuguese shelf varies in width between only about 15 km off Cape Finisterre to more than 50 km off Porto. Rocky outcrops and coarse clastic sediments prevail on the inner shelf between the coast and the 50 m isobath and at the shelf break. Fine-grained largely terrigenous sediments accumulate at present on the middle shelf, resulting in the formation of an elongated mud patch of several tens of kilometers length. The shelf W of Galicia and northern Portugal passes abruptly into a steeply dipping upper slope dissected by numerous deep gullies and canyons. 3.5 kHz acoustic surveys and limited coring indicates the scarcity of recent deposits on the upper slope, with older sedimentary or crystalline rocks cropping out directly at the surface or covered by only a thin veneer of recent sediment. Below 2000 m the lower slope descends slowly to the adjacent abyssal plain and is draped with a smooth and thick cover of hemipelagic sediments. At 3000 m depth the slope is interrupted by Galicia Bank, a protruding block of continental crust rising to less than 600 m depth at its summit.

Ocean margins represent complex physical, biological and geochemical environments with space and time variant mass and energy exchange across the shelf break as well as across the continent-shelf boundary. High rates of primary production on the shelf and at the shelf break are sustained by the input of nutrients from riverine and oceanic origin and by nutrient regeneration in the water column and the sediment. In addition to the in situ generation of biogenic particles, ocean margins receive organic and lithogenic terrestrial particulates from river discharge and by aeolian transfer. The coarse particles largely settle at the continent-shelf boundary, whereas the finer fraction, admixed with particles from marine origin, is subject to deposition-resuspension cycles and may eventually be advected across the shelf break and diluted offshore. Previous studies on ocean-margin exchange of organic matter have indicated that any percentage up to 95% of the annual production on the shelf may be exported to the open ocean. Therefore, off-shelf transport is a variable, but at times a significant sink for organic matter, which may strongly affect the trophic state of modern shelfs.

The multidisciplinary EC-MAST II Ocean Margin EXchange II (OMEX II, 1997-1999) project was conducted to improve our understanding of exchange processes at the NW Iberian Margin. This margin is characterized by a narrow shelf and a steep slope, incised by numerous canyons. Upwelling filaments occurring in summer, downwelling events during winter, and submarine canyons were hypothesized to represent significant transport vectors for suspended matter from the shelf to the open ocean.

Hydrography

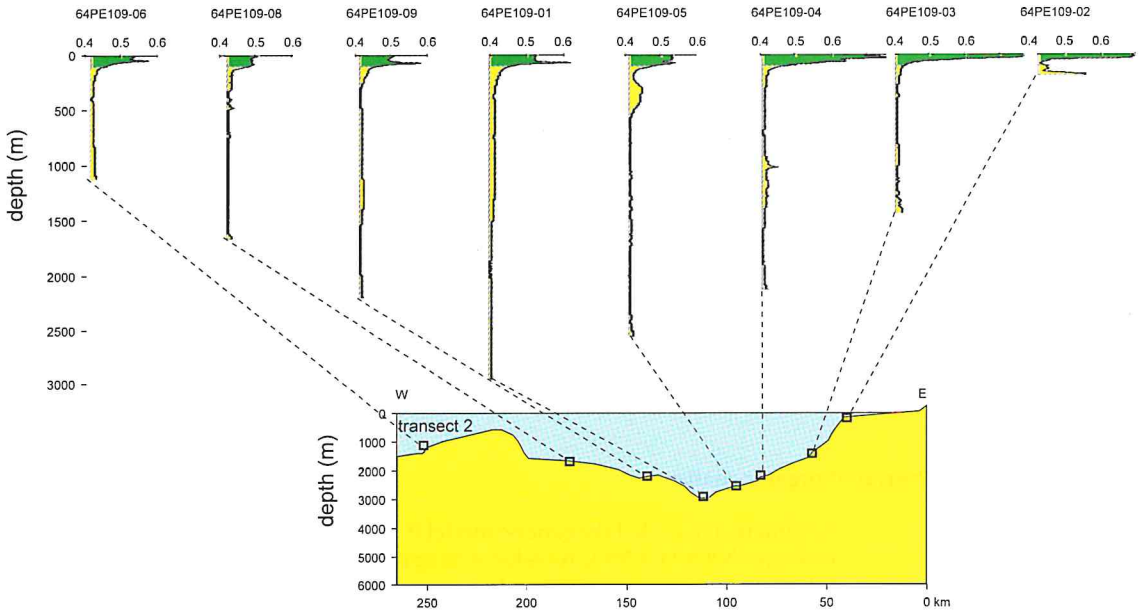
Water mass transport in the mixed layer is subject to seasonal wind induced north-south reversals. Below the surface mixed layer the water masses show a general poleward flow. However, near-bottom currents recorded by the BOBO lander on the Galician slope at 1957 m depth show a pronounced tidal variation, and also marked changes in direction of the residual flow. Maximum current speeds measured with BOBO range between 15-25 cm s^{-1}.



Progressive vector plot of near-bottom currents measured by lander BOBO on the Galician continental slope at 1957 m depth (see map for position) at 1957 m depth in the period from 6 August – 10 September, 1998. Note tidal cyclicity, and change in the residual current direction at the end of August.

Nephelometry

Nepheloid layers - water layers with enhanced particle concentrations - were recognized at various depths along the NW Iberian margin by a reduction in light transmission in transmissometer profiles. Surface nepheloid layers (SNL), corresponding with the biologically productive surficial water layer, were well expressed in all transmissometer profiles. A maximum turbidity in the SNL observed at 50-100 m depth was found to coincide with a distinct subsurface chlorophyll maximum. The decreasing intensity of the SNL in offshore direction reflects the decreasing productivity of the surficial layer.



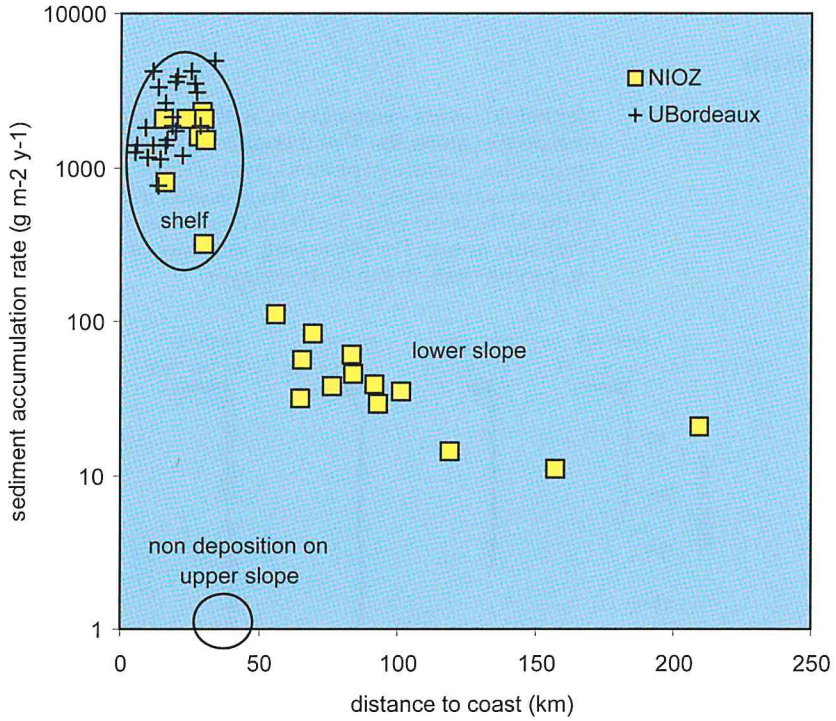
Light attenuation (m^{-1}) profiles along transect 2 off Galicia. Note presence of surface nepheloid layers (green) at all stations, and the restricted presence of intermediate and bottom nepheloid layers.

Bottom nepheloid layers, indicating resuspension of particulate matter in the benthic boundary layer, are well-developed on the shelf, with measured particle concentrations of a few hundred micrograms per litre in excess of concentrations in clear water. In deeper waters on the continental slope, bottom nepheloid layers were only weakly developed, and particle concentrations were only a few tens of micrograms higher than in clear water layers.

Intermediate nepheloid layers, indicative of lateral transport of sediment-loaded water, were only occasionally observed above the upper slope. They may be the extension of bottom nepheloid layers generated on the shelf, and do not extend far offshore. Transport of particulate matter in bottom and intermediate nepheloid layers is likely to follow the predominantly along-slope flow of the deep water masses.

Sediment deposition

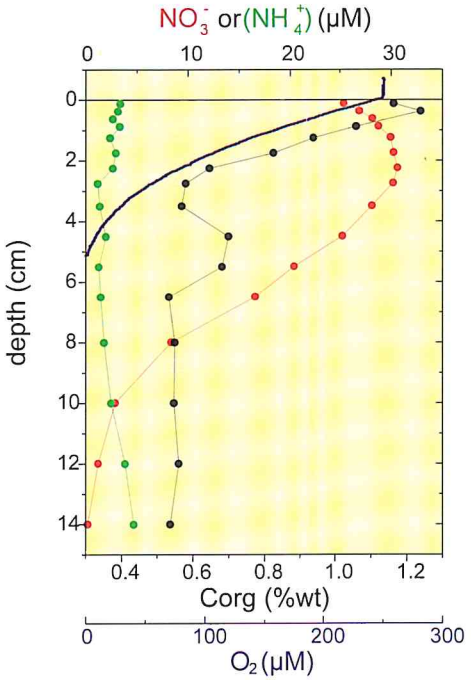
Sediment accumulation rates were determined on the basis of excess ^{210}Pb profiles and planktonic foraminiferal biostratigraphy of sediment cores. Planktonic foraminiferal datum levels were calibrated with ^{14}C AMS dating. Accumulation rates on the shelf ranged from 316 up to 4880 g m^{-2} y^{-1}, with highest fluxes in the mid-shelf mud belt. On all transects recent sedimentation was practically negligible on the steep upper slope. On the middle and lower slope W of Galicia, accumulation rates ranged between 14 and 110 g m^{-2} y^{-1}, generally decreasing in offshore direction. These accumulation rates accord well with mass fluxes recorded in sediment traps deployed by others in the same area at 450 m above the bottom, ranging between 31 and 98 g m^{-2} y^{-1}. The decrease in mass accumulation rates in offshore direction is mainly due to the decreasing flux of terrigenous material with distance to shore. The predominantly slope-parallel transport of water masses appears to effectively prevent dispersal of sediments from the NW Iberian shelf to the slope. An exception must be made for some of the large canyons present along the continental margin, which may intercept sediment transport on the shelf, and form a conduit for rapid sediment transport to the deep sea.



Sediment accumulation rates on the Galician continental margin versus distance to the coast. Note the logarithmic scale. Crosses are data of Jouanneau and Weber, University of Bordeaux.

Mineralisation and burial of organic matter

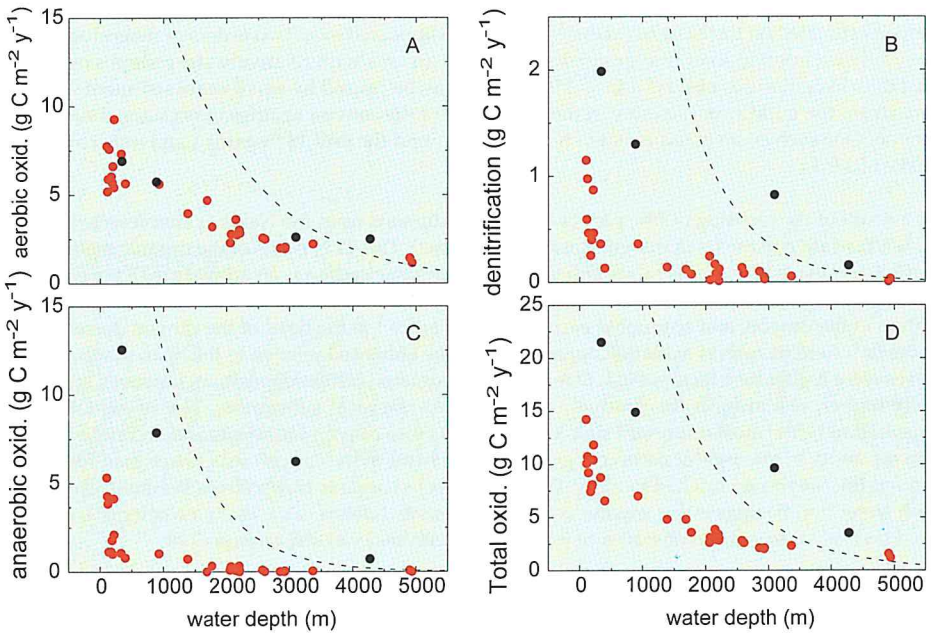
A numerical coupled diagenetic model (OMEXDIA) developed at the Netherlands Institute of Ecology (NIOO-CEMO, Yerseke) was applied to calculate the rates of organic carbon mineralisation. In situ oxygen microprofiles, shipboard measured nitrate and ammonium pore water profiles and sediment organic carbon profiles, were used as model input.



Pore water profiles of in situ oxygen (blue), nitrate (red), ammonium (green), and the sediment organic carbon profile (black) for the OMEX-II sediment trap station at 2200 m water depth. Here, organic carbon degradation is dominated by aerobic respiration as evidenced from the concomitant decrease in organic carbon and oxygen in the upper 5 cm of the sediment. Ammonium, released during aerobic respiration is effectively nitrified to nitrate as evidenced from its low concentration and the subsurface maximum in nitrate. Nitrate diffuses towards the overlying water and downward, where it is used as an alternative oxidant in carbon mineralisation. The asymptotic concentration of organic carbon down-core represents the non-degradable fraction of organic carbon that will be buried permanently.

The burial of organic carbon was estimated from the linear sedimentation rates, the porosity and the residual (refractory) organic carbon concentration at depth in the sediment. The sum of organic carbon mineralisation and burial were taken as a first approximation for the total amount of organic carbon deposited at the sediment surface.

Overall organic carbon oxidation rates for open margin transects were low as compared to other margins in the world. Organic carbon oxidation rates declined from ~11 g C m^{-2} y^{-1} on the shelf down to 1.4 g C m^{-2} y^{-1} at 5000 m water depth. Aerobic carbon oxidation was the major pathway in open margin sediments, accounting for >85% at the rise and abyss. This predominance of aerobic carbon mineralisation points to relatively low deposition fluxes of degradable organic carbon. The reactivity of the degradable organic carbon at the time of deposition, a measure for its quality and nutritious value, was <2.5 y^{-1} on the shelf, declining to <0.5 y^{-1} off shore. This trend reflects the aging and progressive degradation of organic carbon with increasing water depths. The rate constants on the shelf correspond to values for partially mineralised phytodetritus and are somewhat lower than the typical values for margin sediments. The rate constants for slope and rise reflect a more advanced state of carbon degradation and are lower than



Model estimated rates of carbon oxidation in Iberian Margin sediments, showing (A) aerobic oxidation, (B) denitrification, (C) anaerobic oxidation, and (D) total organic carbon oxidation. Open circles indicate stations at the open margin, closed circles represent canyon stations, and dotted lines represent the global empirical relationships. In the canyon, anaerobic oxidation and denitrification are enhanced relative to the open margin stations. Process rates are low compared to global averages except for the two deepest canyon stations, indicating a relatively low deposition of degradable organic carbon at sediments of the NW Iberian Margin.

reported values for other basins of similar water depths. These relatively high ages of the organic carbon indicate a long residence time in the water column, more specifically in the benthic boundary layer, from which it is inferred that rebound processing of organic carbon is important at the NW Iberian Margin. The burial of refractory organic carbon at the stations along the open margin transects declined with water depth from ~5 g C m^{-2} y^{-1} on the shelf to 0.2 g C m^{-2} y^{-1} at 5000 m.

Summing the rates of organic carbon mineralisation and burial shows that the total organic carbon deposition on the open shelf-slope-rise declined with waterdepth from ~16 g C m^{-2} y^{-1} on the shelf down to ~1.5 g C m^{-2} y^{-1} at 5000 m. These rates of organic carbon deposition are low, especially on the shelf for which an annual productivity of 360 g C m^{-2} has been measured. Previously reported empirical relationships between primary production and vertical organic carbon flux at a given water depth predict that approximately 20% of the annual primary production on the shelf arrives at the shelf sediment. A comparison of total organic carbon deposition and the empirically predicted delivery for the shelf implies that >58 g C m^{-2} y^{-1} is oxidised in the water column, laterally advected, or focused in one of the numerous canyons.

Nazaré Canyon

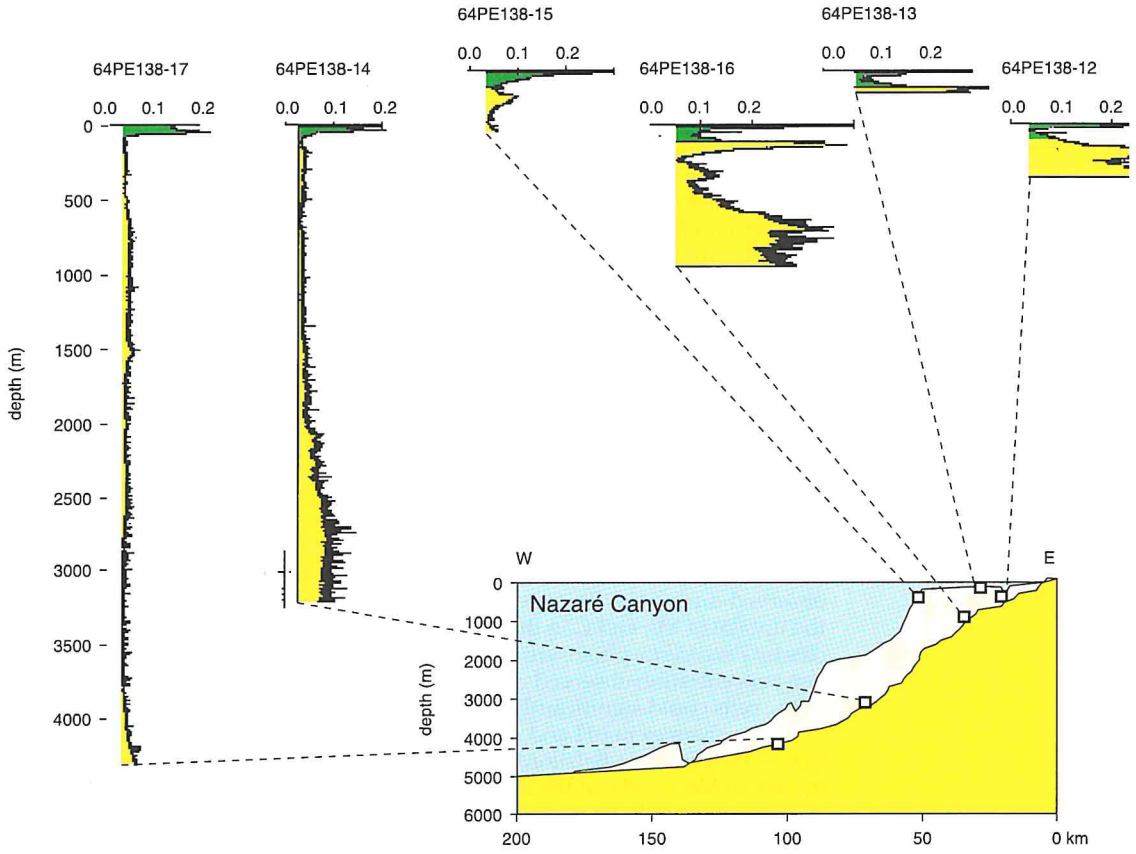
Submarine canyons are considered of particular interest for ocean margin exchange, as they may effectively channel particulate matter transport from the shelf to the deep sea. Between May 21st - 27th, 1999, we briefly visited the Nazaré Canyon, one of Europe's largest canyons situated off the coast of Portugal, during cruise 64PE138 with R.V. "Pelagia". Apart from its large size and the impressively meandering course of its axis, the Nazaré Canyon is particularly interesting because its upper part cuts across the full width of the shelf, its head actually breaching the shoreline. And thus any along-shore and near-bottom transport of particulate matter on the shelf is likely to be intercepted by the canyon, and may be diverted toward the ocean.

Guided by a detailed bathymetric map and detailed acoustic surveying with 3.5 kHz penetrating echosounder, two stations immediately adjacent to the canyon and four in the canyon axis were selected for water column and sediment sampling.

Light attenuation profiles of the water column showed pronounced bottom nepheloid layers in the canyon, sometimes extending more than 1000 m upward from the bottom, as well as conspicuous intermediate nepheloid layers. This is in marked contrast to the Galician slope further to the N, where bottom nepheloid layers were only very weakly developed, and intermediate nepheloid layers were only rarely seen.

In cores from the upper and middle part of the canyon, very soft silty clay with abundant plant debris and mica was retrieved. Inventories of excess ^{234}Th (half-life 24 days) and ^{210}Pb (half life 22.3 years) appeared exceptionally high in the middle part of the canyon, an order of magnitude higher than at comparable depths in cores adjacent to the canyon and on the Galician slope further to the N. This suggests that major deposition of fresh particulate matter occurs in the canyon. Total sediment fluxes in the middle canyon estimated on the basis of excess ^{210}Pb profiles appeared even two orders of magnitude higher than on the Galician slope. The rapid accumulation of fine-grained sediment in an area with relatively steep slopes makes the canyon sediments inherently unstable. Irregularities observed in ^{210}Pb profiles may be caused by small-scale sediment sliding. The presence of coarse sand in cores from the middle and notably in the lower part of the canyon testifies of occasional turbidity currents sweeping through the canyon. One such event could tentatively be dated around the mid 18th century, and may correspond to the infamous Lisbon earthquake of 1755.

As a result of the focusing of fine particulates, the sediments from the Nazaré canyon were strongly enriched in organic carbon (3-4.5 %wt) relative to the open margin stations (0.5-2 %wt). The C/N ratios of the organic matter exceeded Redfield stoichiometry for marine organic matter. These ratios indicate that the organic carbon is an admixture of terrestrial and marine organic carbon which is in sympathy with the microscopic observation of plant debris. Oxidation and burial were equally important sinks for organic carbon in the canyon, and amounted each to ~20 g C m^{-2} y^{-1} in the head of the canyon decreasing with water depth to 3 g C m^{-2} y^{-1} in the fan. Aerobic carbon oxidation appeared not to be enhanced relative to the open margin, despite the fact that diffusive oxygen fluxes were higher by a factor of 3-4. Due to the high organic carbon deposition, however, anaerobic carbon oxidation was substantially higher, resulting in the production of reduced chemical substances. The re-oxidation of these substances with oxygen appeared to be the most important sink for oxygen in these canyon sediments and accounted for up to 75% of the total oxygen flux. The reactivity of the organic carbon deposited in the head of the canyon was lower than for the shelf stations, suggesting that the head of the canyon is enriched in older, laterally advected organic carbon from the shelf. The increasing ages of the organic carbon with water depth suggest that organic carbon is channeled down-canyon at a velocity of 0.6 cm s^{-1}, probably in the benthic nepheloid layers that have been observed to extend up to 1000m above the canyon floor.



Light attenuation profiles of the Nazaré canyon stations, showing very pronounced nepheloid layers.

Conclusion

The burial of refractory organic carbon, and the deposition of labile organic carbon both correlated positively with the sedimentation rates for the Iberian Margin, indicating burial efficiencies of 0.6 to 48%. A single trend for burial efficiency versus sedimentation rate for both the canyon and the open shelf implies that the sedimentation rate is the master variable for the geographical distribution of organic carbon oxidation and carbon preservation on the Iberian Margin. From these observations it is concluded that the Iberian shelf sediments represent only a modest sink for the processing and long-term storage of organic carbon. In contrast, the enhanced rates of carbon mineralisation and carbon burial as estimated for the Nazaré Canyon suggest that the submarine canyons incising the Iberian Margin can be important sinks for organic matter from the shelf.

ON THE ROLE OF PHAEOCYSTIS SP. IN THE BIOGEOCHEMICAL CYCLES OF MANGANESE AND IRON

Contributor: *V. Schoemann*

Phaeocystis is a widespread genus of marine phytoplankton with a unique life cycle that alternates between free-living cells and the colonial form. In the colonial state, the cells are embedded in a mucilaginous matrix that constitutes a particular microenvironment in which the chemical conditions are driven by the photosynthetic activity of the colonial cells. Microenvironments of high pH (e.g. 9) and strong oversaturation in oxygen (e.g. 180%) have been observed by microelectrode measurements around and inside *Phaeocystis* colonies during the photosynthetic activity of the colonial cells at saturating light intensities. These chemical conditions can lead to the precipitation and accumulation of manganese and iron by the

colonies. By this way, the mucus could act as a storage medium for both Mn and Fe. This capacity of storing these essential trace nutrients could give a competitive advantage to *Phaeocystis* compared to other phytoplankton species in Mn and Fe limited environments. *Phaeocystis* could therefore not only play a significant role in the biogeochemical cycles of Mn and Fe but also in structuring the phytoplankton community and the associated food-web.

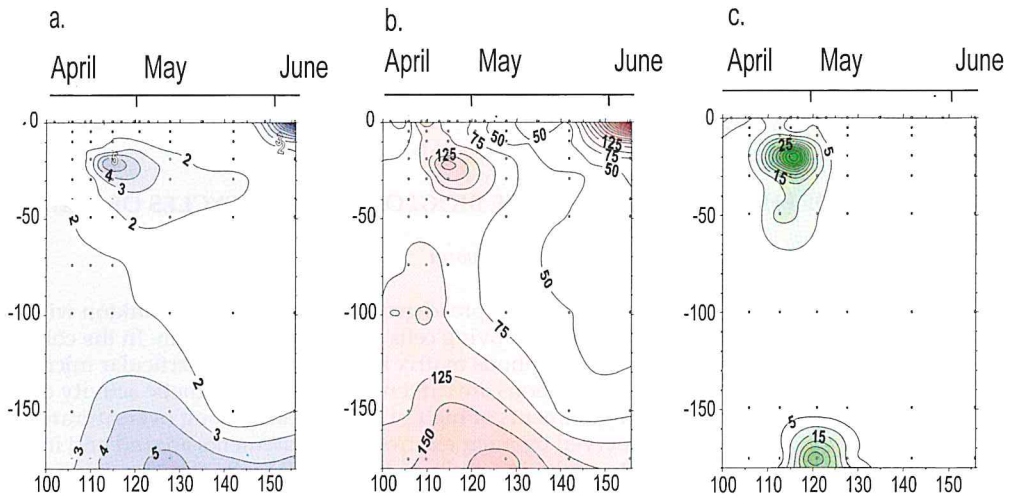
The main objectives of this thesis are to identify the mechanisms of Mn and Fe accumulation by the colonies of *Phaeocystis* and to assess the role of *Phaeocystis* blooms in the biogeochemical cycles of these trace metals. The significance of the Mn and Fe accumulation by *Phaeocystis* colonies and its control by photosynthesis were investigated by performing incubation assays with radiotracers (^{54}Mn, ^{59}Fe and ^{14}C). Experiments were conducted on pure cultures of *Phaeocystis globosa* and on natural communities collected during a *P. pouchetii* bloom in the Balsfjord (Arctic Norwegian fjord) and a *P. globosa* bloom in the Southern Bight of the North Sea. The effects of *Phaeocystis* blooms on the biogeochemical cycle of Fe and Mn were investigated in these two contrasting areas where this alga genus dominates the phytoplankton community. Time series measurements of dissolved and particulate Mn and Fe were undertaken together with the relevant physical, chemical and biological variables during *Phaeocystis* blooms. The project was a co-operation between the Free University of Brussels and NIOZ.

Results of the radiotracer experiments showed significant accumulation of Mn and Fe in the colonies. The intracellular assimilation represented only ~10% of the total uptake of Mn and Fe. Therefore, most of this accumulation occurred in the mucilaginous matrix (~90%) of the colonies. Photosynthesis largely governed the uptake of Mn by the colonies, but only slightly affected the accumulation of Fe. A clear light dependency of Mn-removal from solution was observed during the *Phaeocystis* bloom in Balsfjord. The linear relationship obtained between the uptake of Mn and C in the light suggested the control of dissolved Mn transfer to the particles by *Phaeocystis* photosynthesis in this area. The reported increase in pH and dissolved oxygen concentration observed around and inside the colonies during the photosynthetic activity of the cells could significantly decrease Mn solubility and enhance Mn oxidation rate. In contrast, the changes in pH and oxygen concentration would not significantly affect the precipitation of Fe. Unlike in Balsfjord, there was no significant effect of photosynthesis on the overall uptake of Mn and Fe in the highly turbid coastal waters of the North Sea. Here, manganese and iron removal could be related to the high suspended load.

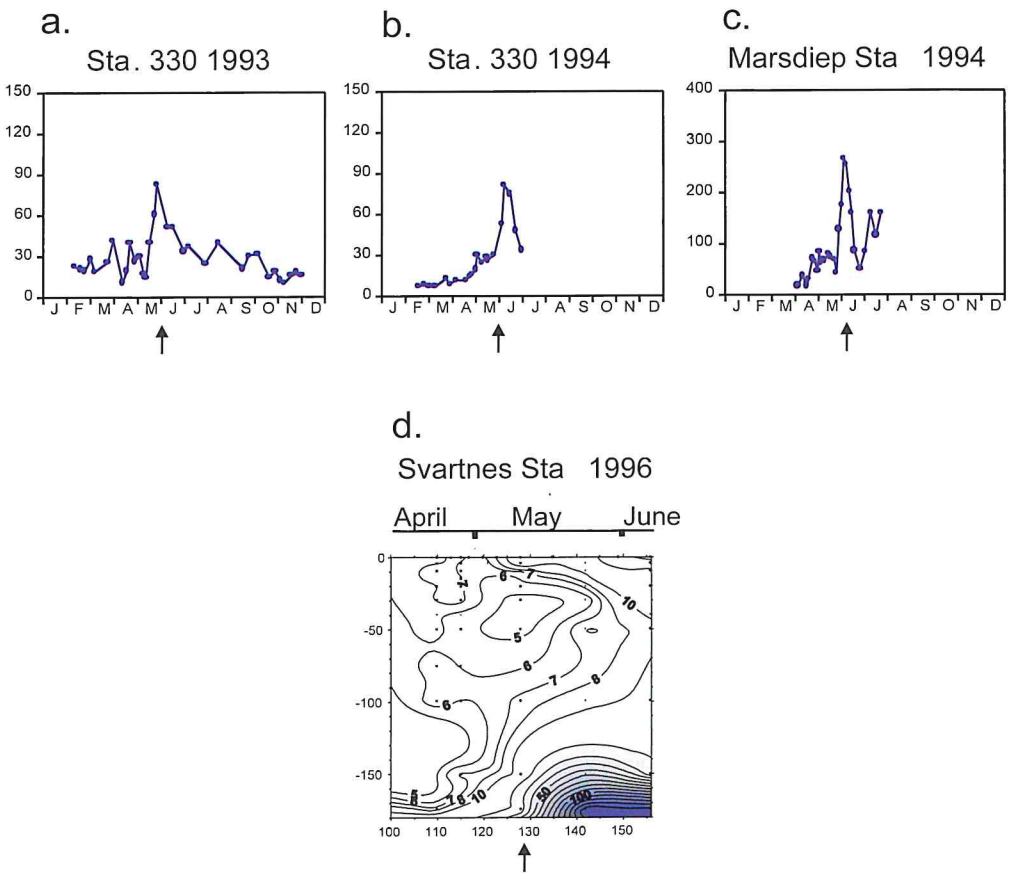
In Balsfjord, the field observations revealed the accumulation of particulate Mn and Fe in the surface waters which could be attributed to the Mn and Fe accumulation by *Phaeocystis* colonies. By contrast, as already indicated by the radiotracer experiments, there was no detectable change in the concentrations of particulate Mn and Fe related to the presence of *Phaeocystis* colonies in the shallow coastal waters of the North Sea.

In both field studies, the production and sedimentation of aggregates produced at the end of the *Phaeocystis* blooms enhanced the removal of manganese, iron and also aluminum from the water column and induced the mass exportation of both associated trace metals and organic matter. The resulting pulse of sedimenting organic matter should have triggered intense bacterial remineralization in the sediments.

After the peaks in *Phaeocystis* blooms, remarkable increases of dissolved Mn were observed in both areas. In the coastal waters of the North Sea, Mn increases were estimated to 0.1-0.3 mmol m^{-2} d^{-1}. A similar increase of dissolved Mn (0.13 mmol m^{-2} d^{-1}) was also recorded in the



Temporal evolution at the Svartnes Station (Balsfjord) in 1996 of the: a. particulate concentrations of Mn>10μm (nM), b. particulate concentrations of Fe>10μm (nM), c. the Phaeocystis colonial cells biomass (μgC liter-1).



Temporal evolution in the coastal waters of the North Sea (Station 330 and Marsdiep Station) and in the Balsfjord (Svartnes Station) of the dissolved concentrations of Mn (nM): a. at the Station 330 in 1993, b. at the Station 330 in 1994, c. at the Marsdiep Station in 1994, d. at the Svartnes Station in 1996. The arrows indicate the end of the spring phytoplankton bloom as expressed by the spring Chl a minimum.

bottom waters of the Balsfjord following the mass sedimentation of the *Phaeocystis* dominated spring bloom. An increase in dissolved Fe was only detected in the Marsdiep (0.49 mmol m^{-2} d^{-1}) in the coastal North Sea. At the same time, a progressive change in the composition of the particulate Mn and Fe in the water column was evident in the Marsdiep. These increases were attributed to an indirect effect of organic matter produced during the spring phytoplankton blooms. The degradation of the organic matter in the sediments leads to anoxic conditions at/or close to the sediment-water interface. For the degradation of organic matter, Mn oxides and then Fe oxides are used as oxidants by bacteria, resulting in the reduction and dissolution of Mn and Fe. Dissolved Mn and Fe may diffuse to the oxic overlying water and can be partly adsorbed or precipitated on the suspended particulate matter. At other stations in the coastal North Sea and in Balsfjord, no increase in dissolved Fe was observed. Under anoxic conditions, Fe is reduced deeper in the sediments than Mn. Due to its very rapid oxidation rate, dissolved Fe is quickly trapped in the particulate matter, even in very thin oxic upper layers of the sediments, and is therefore incapable of escaping to the overlying bottom water. This was also evidenced by fluxes of dissolved Mn and Fe determined experimentally on sediments cores collected close to the Marsdiep. The obtained average calculated fluxes (0.79 mmol m^{-2} d^{-1} and 0.59 mmol m^{-2} d^{-1} for Mn and Fe respectively) were sufficiently high to explain the observed net increases of Mn and Fe in the water column in late spring.

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- Cycling of silicate (NEBROC)
  W. van Raaphorst , W. Helder, E. Koning
- Biological availability of trace elements
  H.J.W. De Baar, K.R. Timmermans
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DEPARTMENT OF MARINE BIOGEOCHEMISTRY AND TOXICOLOGY

The department MBT addresses a field of research at the interface of the basic disciplines of chemistry, geology and biology. The basic questions are:

- **Which organic compounds of either natural or anthropogenic origin are present in the different compartments (biota, sediment, water) of the marine environment ?**
- **What are the reaction pathways involved in their biosynthesis, biotransformation and diagenesis?**
- **What are the reaction kinetics and how are these influenced by environmental conditions ?**
- **In the case of biogeochemistry: when did the reactions take place (geological component) ?**
- **In the case of toxicology: what are the biological effects of the observed concentrations of the parent compounds and their reaction products ?**

The research is divided into the two departmental themes, i.e. 'Biogeochemistry' and 'Environmental Chemistry & Ecotoxicology'. Both are intimately connected to the NIOZ prioritized research area 'transfer of energy and matter in the coastal, continental shelf and continental slope systems' and supply information that is vital to understand the impact of man's actions on ecosystems. A large part of the biogeochemical research is also closely related to the second NIOZ priority 'marine system variability through time'.

In 2000 several new projects were started at MBT among which an exciting field trip to Antarctica, undertaken by the newly hired postdoc Marco Coolen. The goal of this project is to examine the molecular biology and lipid biogeochemistry of Antartic lakes and fjords and the Holocene changes that have occurred.

Several PhD. students successfully defended their Ph.D. theses of which some are described below. Peter Blokker has examined the detailed molecular structure of algaenans, insoluble non-hydrolyzable biopolymers, which occur in a number of algae and are preserved in sediments. Jasper van Heemst has investigated the molecular composition of dissolved organic material, an important carbon reservoir in oceans. Arne van Schanke has finished his project this year that addresses the question whether the biotransformation ability of marine mammals towards anthropogenic contaminants can be derived from the presence of different isozymes of the biotransformation enzyme superfamily cytochrome P450. They explain their PhD work in more detail in the pages following below.

Finally, Kees Booy reports on a project sponsored by RIKZ in which the technique of passive sampling with a semipermeable membrane devise was examined as a method to determine low concentrations of organic contaminants, such as polyaromatic hydrocarbons and brominated flame retardants, in water and in air.

MOLECULAR CHARACTERIZATION OF DISSOLVED ORGANIC MATTER IN SEAWATER

Contributors: *Jasper van Heemst and Jan de Leeuw*

Dissolved organic matter (DOM) plays an important role in the global carbon cycle. However, not much is known about the molecular composition and the origin of DOM. The study described here, which was supported by NWO-ALW, was conducted to gain more knowledge on the molecular composition and the origin of DOM.

The molecular characterization of three DOM samples from the North Pacific Ocean was investigated first. These samples were obtained from Dr. Ronald Benner (University of South

ANALYTICAL PYROLYSIS

Analysing insoluble macromolecular structures is problematic since analytical techniques require that the sample to be analysed dissolves in a solvent (for example, liquid chromatography). Solid state nuclear magnetic resonance (NMR) can give general, semi-quantitative information on the types of carbon atoms present in macromolecules (for example carbon atoms attached to oxygen) but not detailed structural information. Curie-point flash pyrolysis gas chromatography (coupled with mass spectrometry) is a technique that partly solves this problem. A sample is pressed on a ferromagnetic wire that is rapidly heated (usually within 100 milliseconds) by electromagnetic induction to temperatures of up to 770 °C. Since this takes place in an inert atmosphere (for example helium) the macromolecule is broken into several low-molecular-weight fragments which evaporate from the wire and are carried by a stream of helium into the gas chromatograph. The fragments are separated on a capillary column and analysed for their structure by mass spectrometry. By analysing the fragments it is then possible, although with some effort and assumptions, to reconstruct, partly, the macromolecular structure. For example, an insoluble biopolymer occurring in terrestrial material is lignin, which consist of certain types of cross-linked phenolic substances. Upon pyrolysis these phenolic substances are released as fragments and can then serve as a fingerprint for the presence of lignin. Thus, high amounts of these products in pyrolysates of insoluble organic matter from aquatic sediments suggest a significant input of terrestrial organic matter.

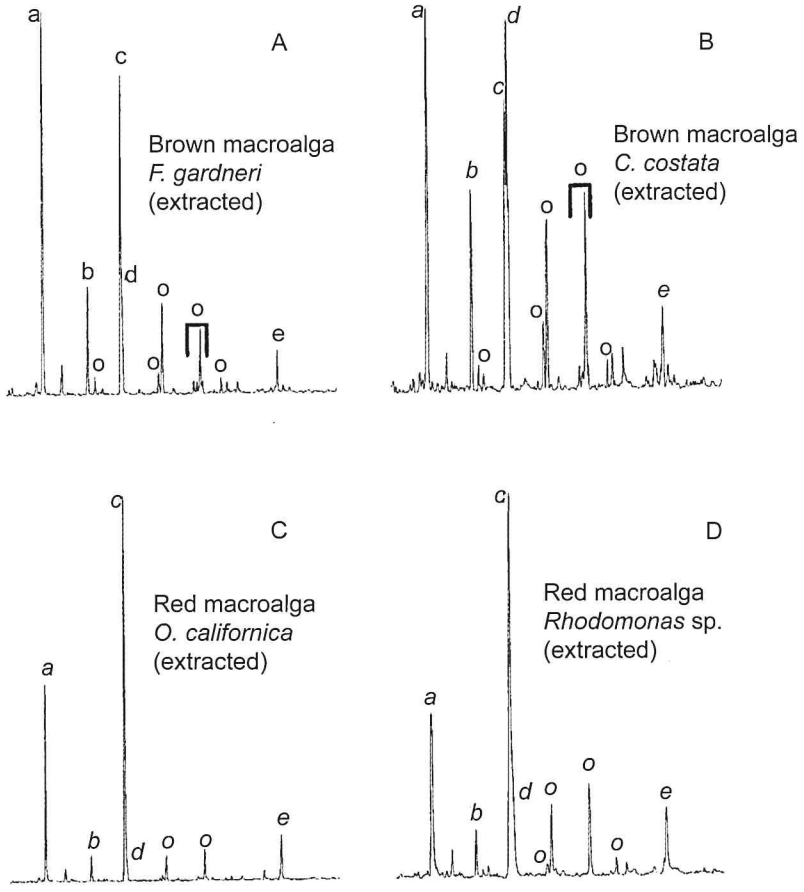
Carolina, USA). They offered the opportunity to compare results and to evaluate our analysis methods. The samples were isolated using tangential-flow ultrafiltration. These DOM samples represent the size fraction of DOM between 0.2 mm and 1 nm (1000 Dalton), here referred to as ultrafiltered dissolved organic matter (UDOM). Samples from the surface water (10 m), the oxygen-minimum zone (765 m) and the deep ocean water (4000 m) were analyzed using analytical pyrolysis. This technique involves the rapid heating of macromolecular material in an inert atmosphere, which leads to the breakdown of the macromolecule into characteristic low-molecular-weight products. Specific pyrolysis products of proteins, lignins and resistant aliphatic biomacromolecules were absent in all samples. A significant amount of nitrogen compounds was encountered in the 10 m-sample. The origin of these nitrogen compounds is currently unknown, but they may be partially derived from aminopolysaccharides originating from bacterial lipopolysaccharides and peptidoglycan. Pyrolyzates of all three samples contained significant amounts of alkylphenols of non-lignin origin.

One hypothesis is that the nitrogen-containing compounds detected in the pyrolyzates of UDOM from the North Pacific Ocean are derived from chitin. To this end the decay of shrimps was studied to test this hypothesis. Solid-state ^{13}C-NMR and analytical pyrolysis was used to analyze the shrimps, the decayed shrimps and a shrimp chitin standard. Comparing the pyrolysis products detected in this study to those, encountered in the pyrolyzates of the Pacific Ocean UDOM led to the conclusion that the nitrogen containing compounds are probably of another origin.

The study continued with UDOM samples from coastal North Sea obtained during a cruise in 1995 of the RV Pelagia and taken during a *Phaeocystis* algal bloom. Some differences were observed between UDOM from inside and outside the bloom area such as the presence of relatively large amounts of unaltered polysaccharides in the algal bloom UDOM sample and the absence of these compounds outside the bloom.

Another part of our study deals with the molecular characterization of UDOM in North Sea water using analytical pyrolysis, ^{13}C-NMR and stable and radiocarbon isotopes. Overall, not much difference in composition of the UDOM from the North Sea was observed. It consisted mainly of refractory organic matter, composed of altered carbohydrate and proteinaceous moieties.

To study the contribution of terrestrial or riverine DOM to seawater DOM, we studied UDOM from the Ems-Dollart. Four different UDOM samples were collected from waters with



Alkylphenols mass chromatograms of pyrolyzates of brown macroalgae (a-b) a red macroalga (c) and a microalgae showing the presence of polyphenolic macromolecules in algae. Key: open dots= C_2-phenols, b = 2-methylphenol, c= 4-methylphenol, d= 3-methylphenol, e= vinylphenol

salinities varying from 0.4 to 20‰. The samples were analyzed using analytical pyrolysis, ^{13}C-NMR and stable and radiocarbon isotopes. All UDOM samples throughout the estuary revealed similar pyrolyzates and ^{14}C activities. Only the ^{13}C-NMR spectrum of the UDOM sample from the water with the highest salinity showed slight differences with those of other samples. The stable carbon isotope values suggest mixing of river DOM with seawater DOM of comparable ages. Pyrolysis products of unaltered polysaccharides, lignins, proteins and lipids were not detected. This further suggests that UDOM consists of a large fraction of refractory organic matter and a very small fraction of fresh labile organic matter.

In order to test the hypothesis that polyphenolic constituents, present in UDOM and particulate organic matter (POM) are of algal origin, a number of macroalgae were first subjected to a number of chemical degradation treatments in order to test the chemical resistance of the polyphenolic moieties present in the algae. It could be shown that brown algae as well as green and red macroalgae contain chemically and possibly biologically very resistant macromolecules, which produce a number of alkylphenols upon pyrolysis (Fig. 1). One of the conclusions was that these algal polyphenolic macromolecules contribute significantly to DOM and POM.

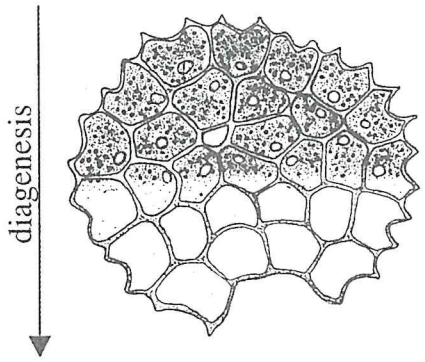
However, it was further shown that alkylphenols present in pyrolyzates may have many different precursors. A number of samples containing organic matter were studied, *i.e.* UDOM, POM, sediments, polysaccharide/protein standards, algae, hydrolyzable tannins, lignins, lignites, coals, soils and insect cuticles. These samples were subjected to various chemical degradation treatments. To some extent, the distribution patterns of the alkylphenols in the pyrolyzates can be used to discriminate their precursors: lignins, proteins and transformed protein. It was concluded that alkylphenols in pyrolyzates of UDOM, POM and sediments reflect polymers, which are formed by cross-linking of protein units containing tyrosine with polysaccharide units, forming non-amide bonds on hydrolysis of polysaccharide/protein material in the water column. Experiments with salts added to the polysaccharide/protein standards were also conducted. It was demonstrated that the presence of a mineral matrix does not cause the production of any artifacts when analyzing these standards using analytical pyrolysis.

As an addition to the molecular characterization of UDOM using analytical pyrolysis, Ems-Dollart UDOM samples along with a number of other fluvial samples were analyzed by thermochemolysis using tetramethylammonium hydroxide (TMAH). This method is a powerful method to study and release lignin moieties from macromolecular organic matter. Only traces of lignin (2-4% w/w) were detected in the Ems-Dollart UDOM samples. As concluded before, "fresh" lignin may be excluded as a major contributor to UDOM.

RESISTANT MACROMOLECULES IN EXTANT ALGAE AND ANCIENT SEDIMENTS

Contributors: *Peter Blokker, Jaap Sinninghe Damsté and Jan de Leeuw*

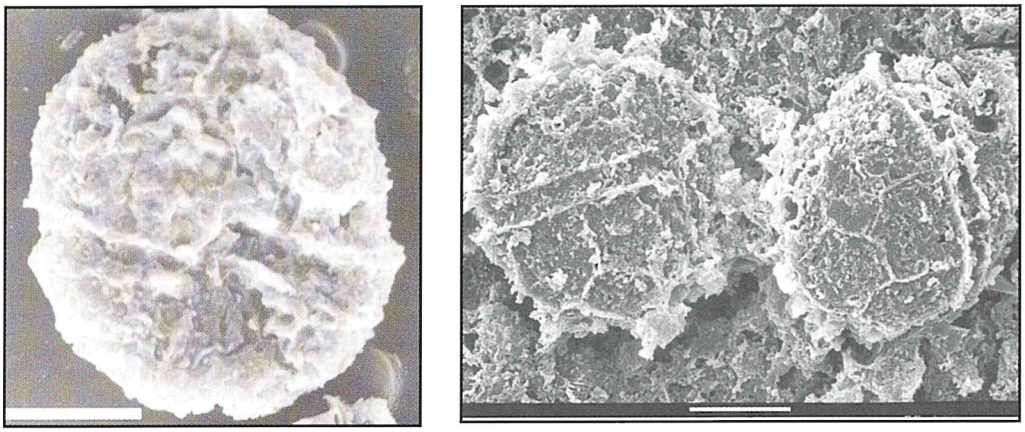
Algaenans are non-hydrolysable insoluble aliphatic biopolymeric materials present in the cell walls of some green microalgae. In these cell walls it serves a protecting role against microbial attack and/or desiccation. Earlier studies have shown that, because of its resistant nature, algaenan is selectively preserved in sediments and that it may constitute a significant part of the insoluble non-hydrolysable macromolecular part of sedimentary organic matter where it can serve as a source material for the formation of oil and gas upon further catagenesis. Thus, a study, which was supported by ALW-NWO, was performed to investigate the structure and occurrence of algaenans in algae and ancient sediments.



A schematic presentation of the selective preservation of an algaenan-containing *Pediastrum boryanum* cell wall.

The first part of our study mainly focused on the chemical composition of these algaenans in algae of the division Chlorophyta. The algaenans were isolated by sequential mechanical, enzymatic and chemical treatments from the green freshwater microalgae *Tetraedron minimum*, *Scenedesmus communis*, *Pediastrum boryanum*, *P. braunii*, *P. kawraiskyi*, *Sorastrum spinulosum* and *Coelastrum reticulatum*. They were analysed using a series of complementary analytical techniques such as: solid–state ^{13}C-NMR, Fourier Transform Infrared Spectroscopy (FTIR), flash pyrolysis–gas chromatography/mass spectrometry (GC/MS) and chemical degradations followed by GC/MS. These analyses showed that the algaenans observed in all these species are composed of long-chain unsaturated ω-hydroxy fatty acids, chemically linked *via* ester and ether linkages.

The resting spores of *Chlamydomonas monoica*, *Spirogyra* sp., *Haematococcus pluvalis* and *Dunaliella* sp. were investigated using the techniques mentioned above. The results showed that all these algal resting states contain non-hydrolysable insoluble aliphatic biopolymers. Chemical analysis of the lipids associated with these algal spores illustrated that they may be an important source of sedimentary compounds like mid-chain diols and hydroxy fatty acids, the origin of which is still unclear. Although some of the compounds freed from the *Spirogyra* zygospores walls upon extraction may originate from a natural contaminant, they



Transmission electron microscopy photographs showing Jetta Gypsum dinocast specimens (Eocene). Scale bar =10 μm. Analysis of this microfossil using RuO4 chemical degradation, FTIR, and flash pyrolysis-GC/MS showed that it is composed of a polymer that formed after the organism died, most likely under the influence of oxygen.

could be rudimentary remnants of a previous terrestrial existence in the evolution of this alga as suggested before on the basis of its sexual reproduction.

Applying the techniques and knowledge obtained from the cultured algae to the sedimentary organic matter illustrated that algaenans are preserved in a chemically intact form. It is possible to recognise the algae on a family level in sediments on the basis of their chemical signature. For instance, algaenans from the algae *T. minimum* were found in 50 My old sediments and are structurally very similar to the extant algaenan. Furthermore, we were able to determine the stable carbon isotopic ratios of algaenans in sediments by analysing specific degradation products with isotope ratio monitoring-mass spectrometry. $\delta^{13}C$ values of both fossil and extant algaenans were determined. This was the first time that a $\delta^{13}C$ value could be appointed to such a species-specific insoluble and non-hydrolysable aliphatic biopolymer in sediments.

Although the results described above imply that probably all algal microfossils are composed of algaenan, during this study two types of microfossils were analysed that are composed of a different type of polymer. It concerns the Ordovician fossils of *Gloeocapsomorpha prisca* and Eocene dinoflagellate fossils (Fig. 2). Upon analysis using RuO_4 chemical degradation, FTIR, and flash pyrolysis-GC/MS it was shown that both microfossil types are probably composed of a polymer that formed after the organism died, most likely under the influence of oxygen species

In summary, the results illustrate that algaenan-containing microalgae are more common in nature than previously thought, especially in lacustrine environments. Furthermore, the results show that algaenans are of chemotaxonomic significance since the chemical composition of algaenans from the order Chlorococcales displays a family specific relationship. Most of the investigated algaenan-containing algal vegetative states from this order of green microalgae

KEROGENS

Kerogen is defined as the part of the organic matter in sediments which is not soluble in common organic solvents. Usually kerogen comprises about 90% of the total organic matter and thus forms a very important part of the geological global carbon cycle. In addition, upon burial in the subsurface of the Earth, this kerogen is thermally heated under high pressure and oil and gas are formed from it. Hence, investigations in the structure and origin of kerogen are of fundamental importance for both scientific and economic reasons.
Currently there are several hypotheses for the origin and formation of kerogen:
- Random cross polymerization of low-molecular-weight polar compounds which have escaped the microbial loop. Successive diagenesis would make the geopolymers increasingly insoluble and unavailable for microbial attack.
- Selective preservation of organic matter by adsorption to mineral surfaces. The mineral matrix would thus protect against microbial degradation.
- Selective enrichment of microbially resistant, insoluble biopolymers in algae and terrestrial plants. These biopolymers are present in low amounts in organisms but upon sedimentation and burial they become selectively enriched due to their low biodegradability.

Research at MBT and at the University Louis Pasteur in Paris, France has mainly focused on the last hypothesis and indeed provided evidence in sediments, algae and terrestrial plants for the existence of insoluble non-hydrolysable biopolymers. Algal biopolymers are termed algaenans whilst terrestrial biopolymers are termed cutans since they occur in the cuticles of plant leaves.

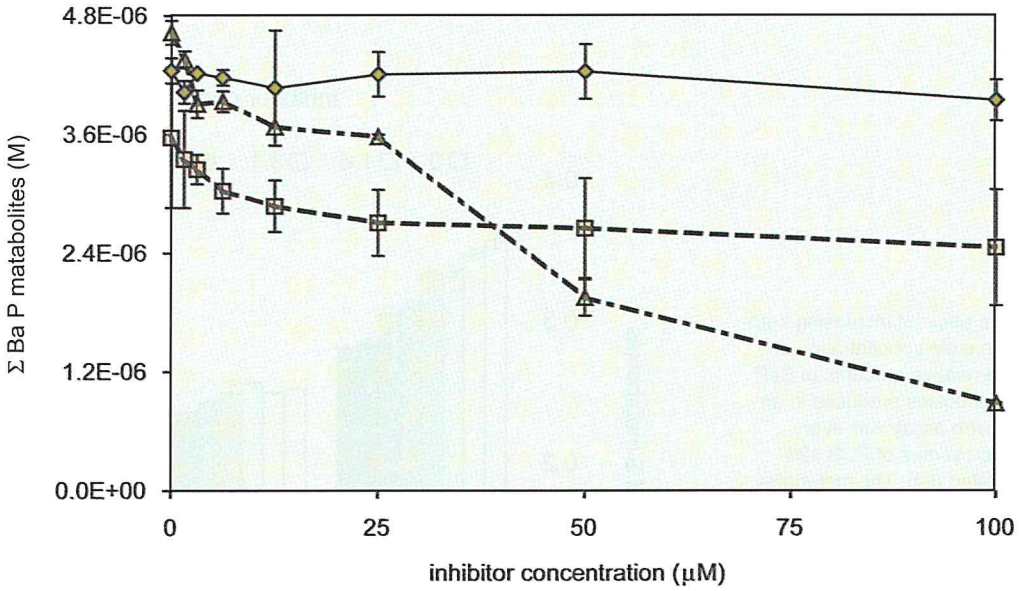
(with exception of *Botryococcus braunii*) use unsaturated long-chain ω-hydroxy fatty acids to construct their algaenan. The algal resting states investigated contain algaenan, but the algae use a wider variety of building blocks including various linear alcohols and carboxylic acids. Investigations on different algal microfossils illustrate that algaenans are preserved in sediments chemically intact and can survive these conditions for millions of years. Finally, it was found that not all microfossils composed of non-hydrolysable insoluble aliphatic polymers are composed of algaenan and that probably oxidative polymerisation could give rise to the morphological preservation of some micro-organisms.

TOXICOLOGICAL MIXTURE INTERACTIONS BETWEEN POLYCHLORINATED BIPHENYLS AND POLYCYCLIC AROMATIC HYDROCARBONS IN THE DAB (*LIMANDA LIMANDA*).

Contributor: *Arne van Schanke, Jan P. Boon*

To assess the risk of contaminants for marine ecosystems it is crucial to know their mechanism of action and their potential interaction with other contaminants. Polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) both are highly toxic classes of compounds, which often are found together in marine biota and sediments where they may form a toxicologically interactive mixture. Exposure of fish to PCBs induces the enzyme CYP1A, i.e. it produces more of this protein than it would do under normal conditions. The enzyme CYP1A is involved in the metabolic breakdown of PAHs. Although metabolic breakdown is intended to detoxify contaminants and to facilitate their excretion as metabolites (e.g. via the bile), it also forms by-products of which some are far more toxic than the original compound. This is because these metabolites can react with DNA to form adducts (stable complexes) which may cause mutations of the genetic material and, eventually, lead to carcinogenesis. The main goal of this project was to characterise the interaction of PCBs and PAHs in fish. Based on the mechanism described above, our starting hypothesis was that PCBs enhance the formation of adducts by PAHs because PCBs induce the enzyme that produces reactive metabolites from PAHs.

To investigate this hypothesis we selected a model PCB (3,3', 4,4',5-pentachlorobiphenyl or PCB 126), a model PAH (benzo[a]pyrene or B*a*P) and a model fish species, the dab (*Limanda limanda*). These specific choices were made because PCB 126 is a strong inducer of CYP1A, B*a*P

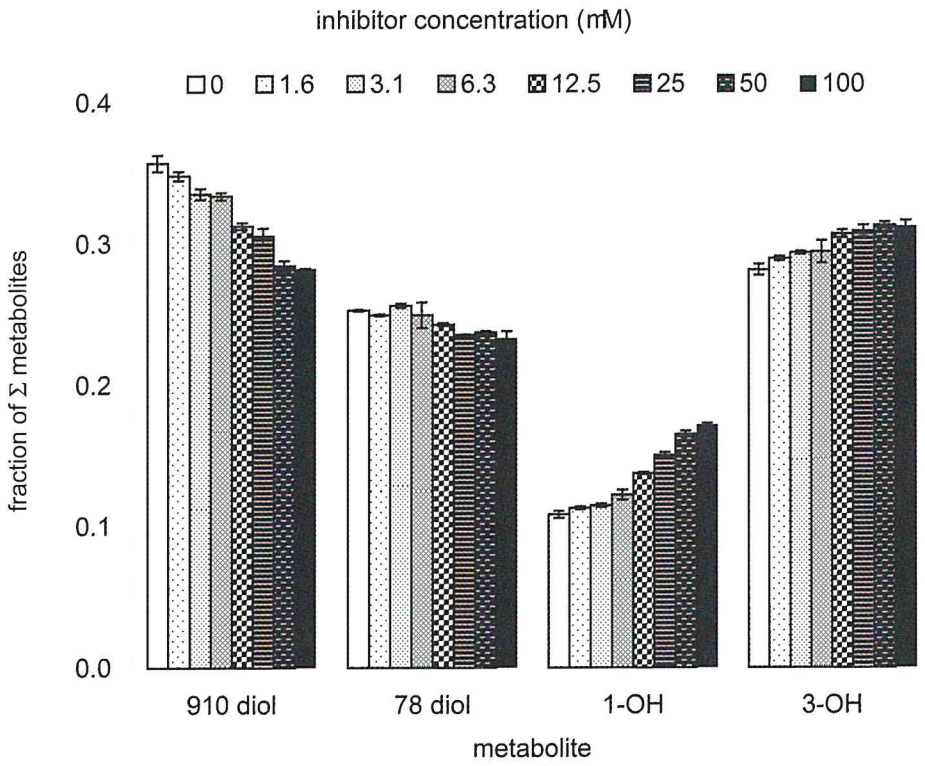


Effects of the CYP3A / CYP2K inhibitor cimetidine (à), the CYP3A / CYP2K / CYP1A inhibitor ketoconazole (s) and PCB 126 (Œ) on B*a*P metabolism in an *in vitro* assay with liver microsomes of PCB 126-treated dab. The lack of inhibition by cimetidine ruled out the involvement of CYP2K and CYP3A in microsomal B*a*P metabolism. Therefore, the effects of ketoconazole must be due to its inhibition of CYP1A. Treatment of live dab with PCB 126 resulted in microsomes with a fivefold higher activity towards B*a*P compared to microsomes of untreated animals. Nevertheless, the same molecule is also a potent inhibitor of B*a*P metabolism when it is added to the *in vitro* incubations. This apparent discrepancy can be explained by the large excess of substrate (B*a*P) that is added in the *in vitro* assay. This excess successfully competes for active sites with any remaining PCB 126 molecules. *In vivo*, such an excess of B*a*P cannot occur, and B*a*P metabolism is inhibited.

is a potent carcinogen and dab is used often as an indicator species in pollution monitoring programmes in the North Sea. We tried to develop biochemical assays to assess the biological responses caused by the model compounds and to investigate the applicability of these assays as a diagnostic tool for the exposure to PCBs and PAHs. Finally, we determined whether effects of PCB 126 and B*a*P could be extrapolated to other PCBs and PAHs, and compared dab with a few other fish species in their PAH metabolism.

Fish were caught by beam trawling in the North Sea during several cruises with the R.V. Pelagia and maintained in the experimental sea water facility of NIOZ. A series of experiments was performed to establish the dose- and time response of B*a*P, as well as the effects of PCB 126 on its metabolism. B*a*P was found to induce the activity of the enzyme CYP1A, but only at relatively high doses. PCB 126, on the other hand, was found to be a stronger CYP1A inducer, as the dose, which was required to produce induction, was more than 1000 times lower. Furthermore, the concentrations of B*a*P metabolites in the bile were found to increase with B*a*P dosage levels, and to decrease with time after exposure. These properties allow the use of biliary metabolites as an indicator for recent exposure of dab to PAHs. When dab were pre-treated with PCB 126 and subsequently exposed to B*a*P, this resulted in a relative decrease in DNA adducts and concentrations of biliary metabolites and moreover, a change in the *relative* amounts of metabolites. This change was surprising because it could not be explained with the initial hypothesis in which only a single enzyme, CYP1A, was held responsible for the metabolic breakdown of B*a*P.

Further research was conducted to explain these findings and to identify the putative secondary enzyme involved in B*a*P metabolism. Here we applied specific enzyme inhibitors which block the activity of one enzyme while leaving other enzymes unaffected. Livers can be purified into microsomal fractions that contain only the enzymes of interest. These microsomal fractions were still able to metabolise B*a*P in an *in vitro* assay. We successively tested the effect of specific enzyme inhibitors on this *in vitro* B*a*P metabolism. Inhibitors with specific affinity for CYP2K and CYP3A had no effect on B*a*P metabolism, thus we could exclude the participation of these enzymes in the reaction. Inhibitors with affinity for CYP1 enzymes, however, always affected *in vitro* B*a*P metabolism albeit that their effects were different in microsomes from untreated and PCB 126 treated animals. Only in the latter, a metabolite pattern shift occurred whilst inhibition occurred in both. From these results we concluded that in PCB 126-treated dab two CYP enzymes are involved in B*a*P metabolism and moreover, that both enzymes must be CYP1 forms. In collaboration with Dr Celine Godard from WHOI, we were able to identify CYP1B as the secondary B*a*P metabolising enzyme in dab. Furthermore, PCB 126 was found to inhibit both enzymes in the *in vitro* assay.



The effect of increasing ketoconazole concentration on the relative amounts of B*a*P metabolites produced in an *in vitro* assay with liver microsomes of PCB 126-treated dab. The metabolite pattern shifts towards lower contributions of the metabolites B*a*P-7,8-diol and B*a*P-9, 10-diol and higher proportions of 1-OH-B*a*P and 3-OH-B*a*P. Such a shift was not observed in microsomes of untreated dab. We concluded that treatment with PCB 126 led to the formation of an additional CYP enzyme, which is involved in B*a*P metabolism.

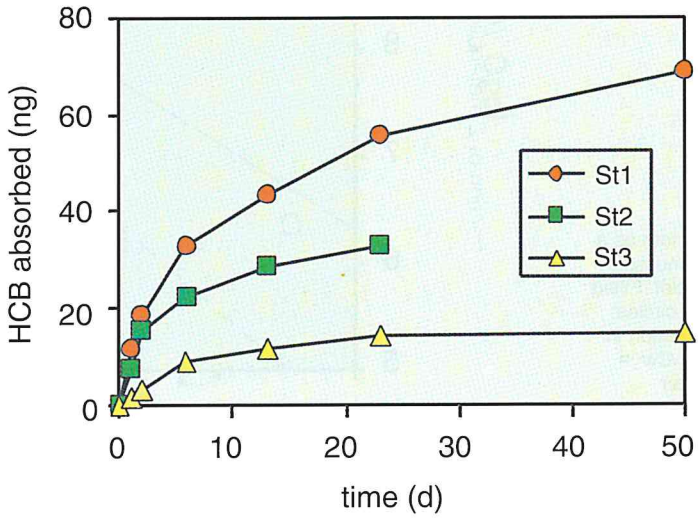
Summarising, the effect of PCB 126 on B*a*P metabolism in dab can be described as follows. Dabs possess two enzymes capable of metabolising B*a*P, CYP1A and CYP1B, and these enzymes produce different metabolite patterns. A probable mechanism could be that in untreated dab, CYP1B only is active, whereas treatment of dab with PCB 126 leads to the induction of CYP1A. This could explain the observed change in the metabolite pattern in PCB treated animals. However, we also demonstrated that PCB 126 can inhibit B*a*P metabolism. Apparently, PCB 126 has two contrasting effects on contaminant metabolism. On the one hand, it induces the production of the CYP1A enzyme thereby increasing the number of protein molecules. On the other hand the PCB 126 molecules remain present in the liver and occupy the active sites of many of these newly synthesised proteins, thereby reducing the capacity of the liver to metabolise B*a*P. The net effect of these opposite forces is a reduction of BaP metabolism by the fish.

Another PCB, 3,3',4,4',5,5'-hexachlorobiphenyl (PCB 169), was even a stronger inhibitor in our *in vitro* assay and inhibitory properties of other PCB congeners have been reported in the literature. The rate of metabolism of B*a*P was compared with some other PAHs in the *in vitro* assay. In dab, pyrene was metabolised faster than B*a*P, but chrysene and phenanthrene were metabolised slower. Seven other fish species were compared to dab in their preference for these PAHs and showed remarkable differences. Except that the pyrene metabolite was always dominant in the product spectrum, no general "metabolisability" sequence of PAHs could be established that was valid for all species. The magnitude of the pattern difference did not resemble evolutionary affinity. This may imply that environmental (as induction) rather than genetic factors may account for this difference between species.

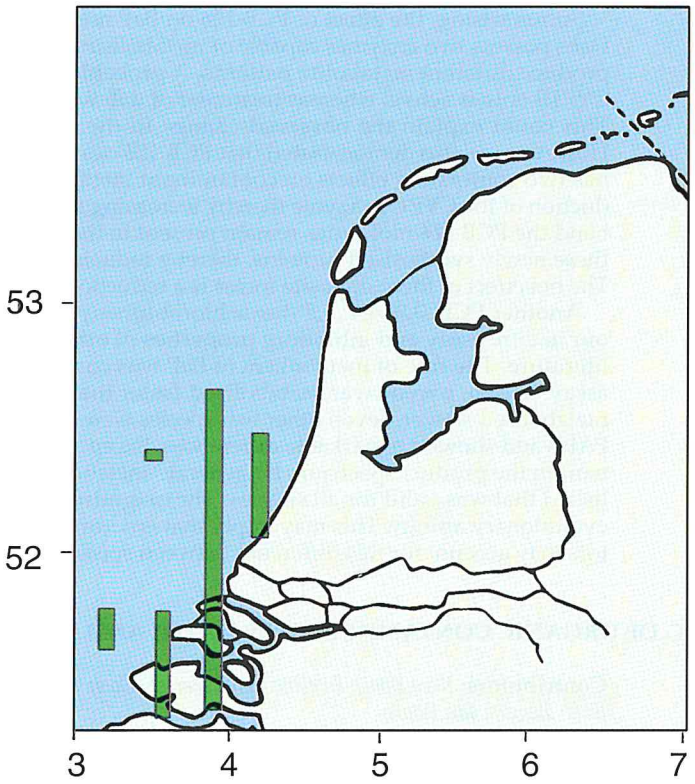
PASSIVE SAMPLING OF ORGANIC CONTAMINANTS IN WATER AND AIR

Contributors: *Kees Booij, Eveline van Weerlee, Coen Fischer, José Hoedemaker, Barend van Drooge, Bart Zegers, Jan Boon*

Water and atmosphere play a central role in the transport of organic contaminants on a global scale. Most of these contaminants are (or were) produced deliberately (e.g. pesticides, polychlorinated biphenyls, brominated flame retardants), but some are generated unintentionally as a side product of human activities (e.g. chlorinated dibenzodioxins), or have natural sources (e.g. polyaromatic hydrocarbons). Many organic contaminants are hydrophobic (= water fearing) and thus strongly attach to other organic phases in the environment such as suspended matter, sediment and biota. Once present in the food web, organic contaminants accumulate in the lipids of marine organisms. Food-chain accumulation especially occurs from gill-breathing preys to lung-breathing top-predators, where the highest concentrations are detected. Despite the fact that contaminant concentrations usually are in the femtomolar range in water and atmosphere, these media are the main carriers of organics on a global scale, because of their huge volume and mobility relative to other phases. Accurate knowledge of concentrations of dissolved contaminants is of special significance, since contaminant transport between the different marine environmental compartments mainly takes place via the water phase. In addition, the equilibrium concentrations in biota, suspended matter and atmosphere can be predicted from the aqueous concentrations. However, the accurate determination of aqueous concentrations of organic contaminants is difficult, because of the low aqueous concentrations, which require large water samples (~50-500 L) and correspondingly large sampling equipment.



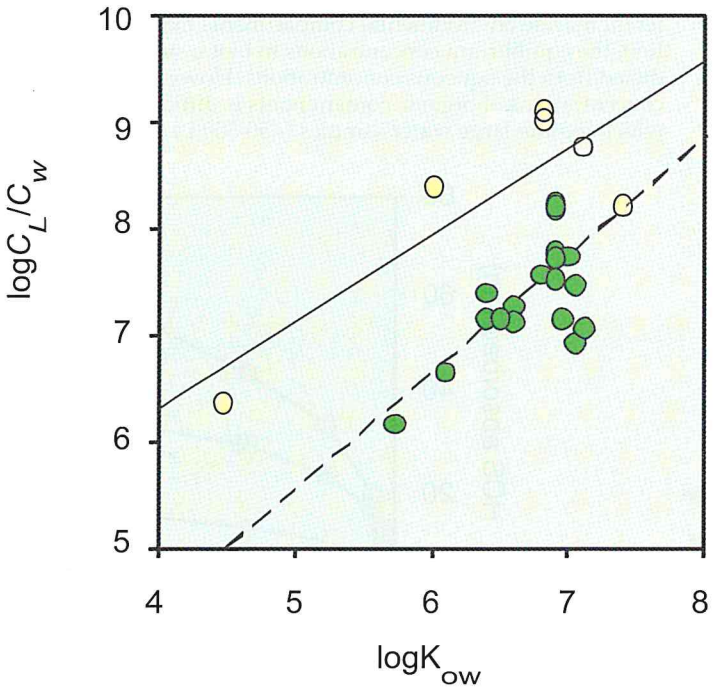
Uptake of hexachlorobenzene by LDPE membranes from field contaminated sediments in the Ems-Dollard estuary. St1: discharge site, St2: intermediate site, St3: Wadden Sea site.



Pyrene in the Dutch coastal waters measured with SPMDs (January 1999). The largest bar represents a concentration of 2.5 ng/L

In addition, adsorption of dissolved contaminants to sampling equipment and incomplete separation between dissolved, colloidal, and particle bound organics make results difficult to interpret.

With passive sampling using Semipermeable Membrane Devices (SPMDs) that were introduced by Huckins (US Geological Survey), many of these problems can be eliminated. SPMDs typically consist of a 2.5 cm wide, 30-100 cm long low density polyethylene lay-flat tubing with a wall thickness of 70 to 90 micrometer, that is filled with a synthetic lipid. When SPMDs are exposed to the water phase, organic contaminants initially are absorbed at a constant rate that is proportional to the aqueous concentration of the analytes. Compounds with a relatively low hydrophobicity reach equilibrium after some days-or weeks during the exposure, while highly



Bioaccumulation factors as a function of Kow for mussels in the Western Scheldt. Filled circles: BDEs, open circles: PCBs. CL= concentration in mussels (ng/g lipid); Cw = concentration in water (ng/mL); Kow = octanol-water partition coefficient (= compound's hydrophobicity).

hydrophobic compounds reach equilibrium only after months or years. Since the typical exposure time of SPMDs is 30-50 days, these compounds remain in the linear uptake phase during exposure. The uptake rate can be interpreted as an apparent water volume extracted per day.

We studied the apparent water sampling rate in the laboratory under controlled hydrodynamic and temperature conditions. The sampling rate was the same for all contaminants studied, and was weakly dependent on temperature. One of the weaker points in passive sampling is that the sampling rate increases when water flow velocities increase. This problem could be dealt with by spiking a number of compounds that do not occur in the environment into the SPMD prior to exposure (Performance Reference Compounds, PRCs). In-situ sampling rates could be calculated from the dissipation of these PRCs during exposure. Using this technique we could show that SPMD sampling rates were essentially the same for a number of stations in the Dutch coastal waters.

Gradients of PolyChlorinated Biphenyls (PCBs) and PolyAromatic Hydrocarbons (PAHs) were studied in the Dutch coastal waters using SPMDs and common mussels transplanted from a supposedly clean site in the Eastern Scheldt. The results for mussels were more difficult to interpret than the results for SPMDs, due to the high background concentrations in mussels, which causes the exposure concentrations in remote areas to be overestimated, and because of inter-site differences in the physiological state of the mussels, due to differences in suspended particulate matter serving as food. Concentration gradients between the Western Scheldt and the open North Sea spanned a factor of 10 for PAHs and a factor of 50 for PCBs.

SPMDs were also successfully applied in a field study on bioaccumulation by mussels in the Western Scheldt. Extremely low aqueous concentrations of brominated diphenyl ethers (pg/L range) were well above the SPMD blank values. Bioaccumulation factors of tetra- and pentabrominated PBDE congeners were about an order of magnitude larger than for comparably lipophilic PCBs, but the bioaccumulation of the fully brominated decabromo diphenylether was very low. Because of its size, this molecule apparently experiences a high resistance towards migration through phospholipid biomembranes.

The extent of air-water equilibrium was studied in the Western Wadden Sea by simultaneous exposure of SPMDs to water and atmosphere. Air-water equilibrium was observed for PCBs, but not for hexachlorobenzene, which was oversaturated in the air phase by a factor of about 7.

The measurement of contaminant pore water concentrations is exceptionally difficult with filtration/extraction methods because of the high amounts of colloids in pore waters, and the high amounts of sediment needed to obtain a sufficiently large volume of pore water. Simultaneous exposure of passive samplers to pore water and to overlying water allows for evaluating whether sediments act as a local source or as a sink of organic contaminants. LDPE membranes were successfully used to assess horizontal gradients of aqueous hexachlorobenzene in pore waters near a contaminated site in the Ems-Dollard estuary, an exercise that would not have been possible with traditional large volume filtration/extraction techniques.

This program was supported by a grant from the National Institute for Coastal and Marine Management (RIKZ).

EXTERNAL PROJECTS OF THE DEPARTMENT OF MARINE BIOGEOCHEMISTRY AND TOXICOLOGY

- A molecular and carbon isotopic biogeochemical study of environmental conditions leading to deposition of "black shales" during the Cenomanian/Turonian oceanic anoxic event (NWO-ALW)
  M.M.M. Kuypers, J.S. Sinninghe Damsté
- Marine microalgae as major contributors to marine sedimentary organic matter and crude oils (NWO-ALW)
  P. Blokker, J.S. Sinninghe Damsté, J.W. De Leeuw
- Climate history of the South East Atlantic Ocean (NEBROC)
  G.J.M. Versteegh, F.J.H. Jansen, J.S. Sinninghe Damsté, J.W. De Leeuw
- Climate variability on a decadal time scale in the North Sea as revealed by biomarker analysis (NEBROC)
  B.E. Van Dongen, J.S. Sinninghe Damsté
- Molecular and geochemical analysis of hot spring cyanobacterial and Chloroflexus mats as stromatolite analogs (NASA)
  M.TJ. Van Der Meer, J.W. De Leeuw
- Neogene history of the Benguela Current and climate in southeastern Africa: a high resolution study of biomarkers and planktonic Foraminifera (NWO-ALW)
  E. Schefuß, G.J.M. Versteegh, F.J.H. Jansen, J.S. Sinninghe Damsté
- Coccolithophorid evolutionary biodiversity and ecology network (ECEU-TMR)
  H. Kinkel, G.J.M. Versteegh, J.S. Sinninghe Damsté
- Decadal climatic changes in the Holocene as revealed by biomarker records in finely laminated marine sediments (NWO-ALW)
  R. H. Smittenberg, J.S. Sinninghe Damsté
- Action to demonstrate the harmful impact of TBT. Effective communication strategies between scientists and policy makers to assist in policy development (EU-LIFE).
  J.P. Boon, C.C. Ten Hallers-Tjabbes
- Occurrence of polybrominated diphenylether (PBDE) flame retardants in marine foodwebs and sediments (BSEF).
  J.P. Boon, B. Zegers
- Passive sampling of organic contaminants in the waterphase (RWS/RIKZTNW*MILLAB part of TIB)).
  K. Booij, C.V. Fischer, E.M. Van Weerlee
- Impact of TBT in Neptunea antiqua from the North Sea (DGG)
  C.C. ten Hallers-Tjabbes
- Carbon Isotopic Biogeochemistry of Eastern Mediterranean Mud Volcanoes (NWO-ALW).
  R.D. Pancost, J. Werne, J.S. Sinninghe Damsté
- Rapid global change during the Cenomanian/Turonian oceanic anoxic event: Examination of a natural climatic experiment in Earth history (CT-Net).
  A. Forster, S. Schouten, J.S. Sinninghe Damsté
- Sulfurised carbohydrates: An important sedimentary sink for organic carbon? (NEBROC)
  B. Van Dongen, S. Schouten, J.S. Sinninghe Damsté
- Chemical fossils of diatoms for age determination of petroleum: Improved tools for solving exploration and production problems (NWO-STW).
  G. Muyzer, S. Schouten, J.S. Sinninghe Damsté
- Early diagenetic transformations of carotenoids: A key to understanding past environmental changes (NWO-ALW).
  E.C. Hopmans, J.S. Sinninghe Damsté
- A historical molecular record of Holocene environmental changes from Antarctic sediments of stratified fjords and lakes (NWO-ALW/NAAP).
  M. Coolen, G. Muyzer, S. Schouten, J.S. Sinninghe Damsté

DEPARTMENT OF BIOLOGICAL OCEANOGRAPHY

The Department of Biological Oceanography focuses on the role of planktonic organisms in the carbon and energy fluxes and nutrient recycling in the North Sea and the Atlantic Ocean. Specific emphasis is put on the complex interaction between bottom-up and top-down control mechanisms in the lower planktonic food web.

In the year 2000, two projects (BIOHAB and COMET) were started, which are funded by the European Union and co-ordinated by the BIO. The ultimate goal of BIOHAB is to determine the susceptibility of harmful algal blooms to biological control such as grazing (by copepods, ciliates, hetero- and mixotrophic dinoflagellates) and infection (by viruses, bacteria, parasites). We also investigate the release of infochemicals by harmful algal blooms into the ambient seawater. Already existing data sets on growth and decay of harmful algal bloom-species in various coastal regions are used to develop a generic or species-specific model for the development of harmful algal blooms and their mitigation. The co-operation involves institutes of several European countries, representing various coastal areas such as the Baltic and the North Sea, the coastal zone of Norway and the Mediterranean. A major mesocosm experiment has been performed using the facilities available at BIO. The dynamics of a Phaeocystis bloom under different nitrogen and phosphorus supply ratios have been followed over 4 weeks.

The other EU-funded project, COMET, investigates the role of ultraviolet radiation on the availability of dissolved organic matter and metals for the lower trophic food web in the coastal North Sea and the river Rhine. Particular attention is paid to the role of metals in catalyzing photochemical alteration of dissolved organic matter. In this project, metal chemists and microbial ecologists from 6 different European countries are collaborating.

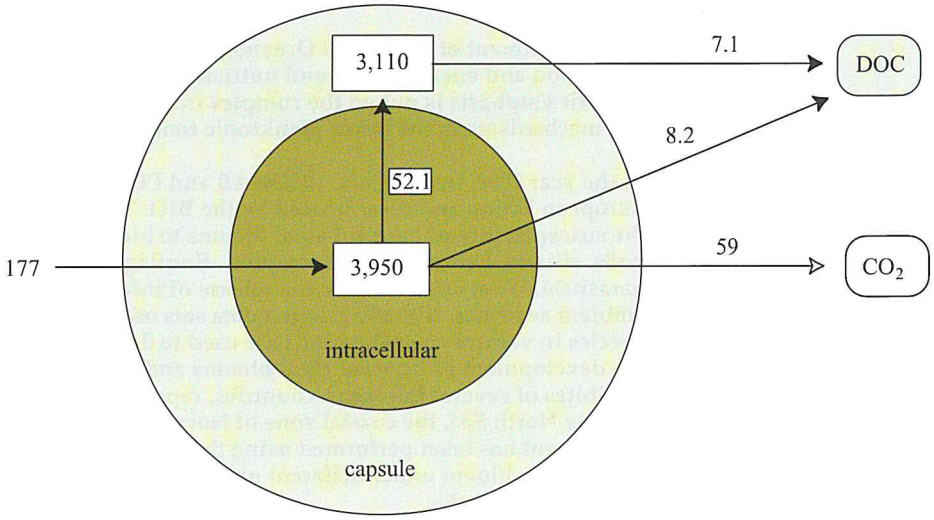
Extensive field work was performed in the North Sea, the subtropical Atlantic and the Southern Ocean. Cruises in the North Sea (Plume & Bloom project) funded by ALW and with input from MCG, were carried out to investigate the role of non-phytoplankton food for mesozooplankton and to elucidate the importance of clay and nutrient transport for the dynamics in productivity of the southern North Sea. One of the main objectives of these cruises was also to elucidate the cause of distinct phytoplankton blooms in a specific area of the southern North Sea, the so-called Frisian Front. These cruises were also used to determine the role of suspended clay on the grazing efficiency of protists on bacterioplankton and to take samples for molecular characterization of the viral and bacterioplankton community structure. The dynamics of the growth yield of bacterioplankton were also investigated to refine our knowledge on the role of bacteria in the carbon flow of the North Sea.

Ingrid Obernosterer defended her Ph.D. thesis " Photochemical transformation of dissolved organic matter and its subsequent utilization by marine bacterioplankton" at the University of Groningen. A summary of her work has been given in the Annual Report of the NIOZ in 1999.
Karen Stoderegger finished her EU-TMR project on the "Bacterioplankton exopolymer production and reactivity and contribution to the oceanic dissolved organic carbon pool" and defended her Ph.D. thesis at the University of Vienna. A description of her work is given below.

PRODUCTION AND RELEASE OF THE EXOPOLYSACCHARIDE CAPSULE OF MARINE BACTERIOPLANKTON AND ITS BIOAVAILABILITY TO BACTERIOPLANKTON

Contributors: *Karen E. Stoderegger, Gerhard J. Herndl*

The bacterial capsule consists mainly of polysaccharides and plays an important role in protecting the cell from a variety of potentially harmful substances. However, the role of the capsule in the life cycle of a bacterial cell, in particular, and in the oceanic carbon and energy cycle, in general, is essentially unknown. One of the fundamental questions is whether the capsule is a by- or waste-product of bacterial metabolism and whether it has a specific ecological function. Based on a variety of methods there is some general consensus that less than 50% of the bacterioplankton present are metabolically active. Also, a highly significant relationship has been obtained between the integrity of intracellular structures and the presence of a bacterial capsule. Thus, it might be concluded that the capsular envelope is lost rapidly when bacteria become inactive. The large fraction of inactive bacteria present in all the aquatic systems studied thus far indicates that they are not grazed very efficiently and it might be hypothesized that

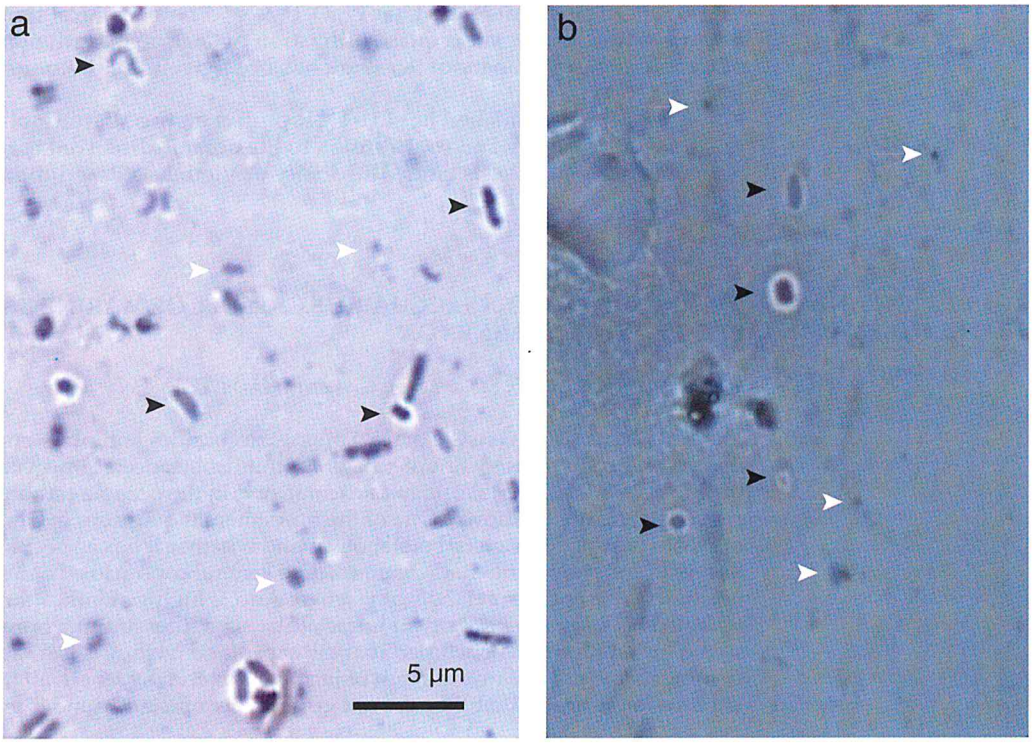


Summary of the carbon flow through a bacterial cell and into the different compartments. Concentrations are given in amol C $cell^{-1}$, rates in amol C $cell^{-1}$ h^{-1}. On average, a bacterium takes up 177 amol glucose C $cell^{-1}$ h^{-1} and releases 59 amol C $cell^{-1}$ h^{-1} in the form of CO_2 leaving, on average, 66 amol C $cell^{-1}$ h^{-1} for the intracellular pool and 52.1 amol C $cell^{-1}$ h^{-1} for the production of capsular material. Based on the release experiments we calculated a direct release from the capsule of 7.1 amol C $cell^{-1}$ h^{-1} and a release from the intracellular pool of 8.2 amol C $cell^{-1}$ h^{-1}. Thus the total release of bacterial-derived DOC represents approx. 25 % of the bacterial respiration.

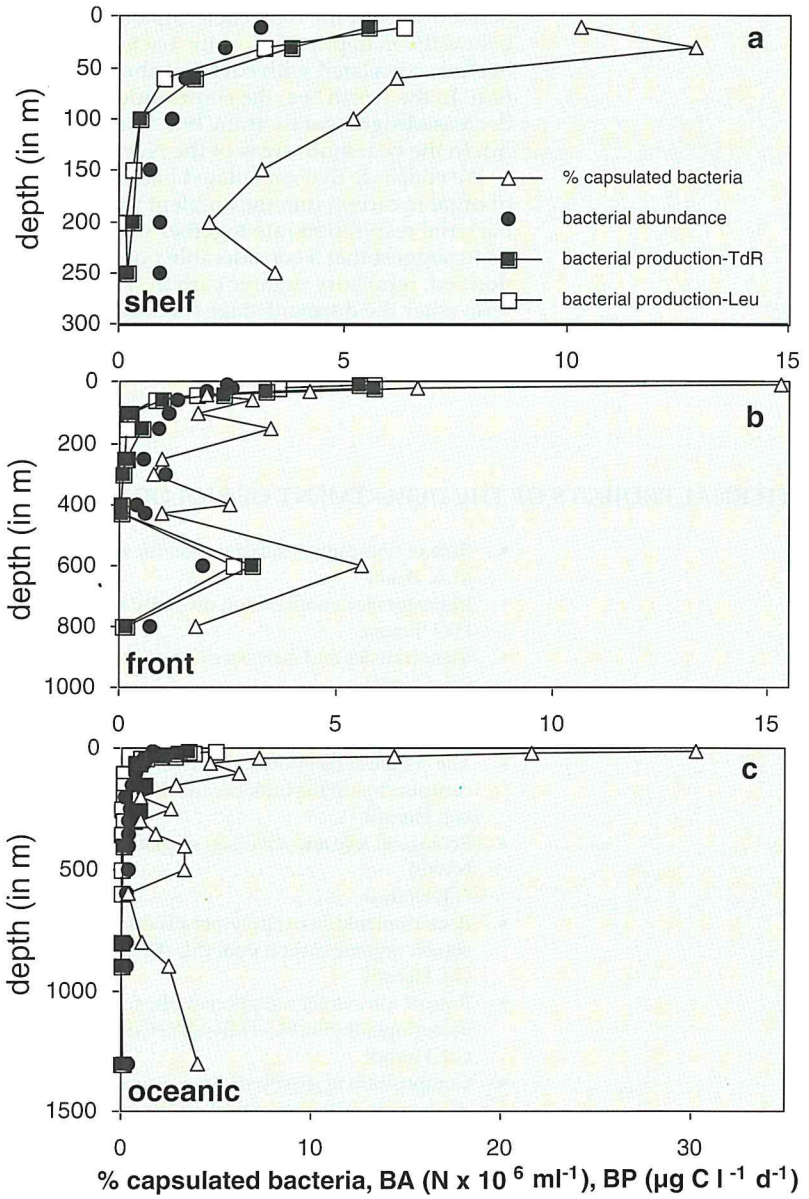
the polysaccharidic envelope of bacteria is responsible for regulating prey selection by bacterivorous protists.

Experiments were mainly performed on dilution cultures from the coastal North Sea. The distribution of capsulated bacteria was monitored during 2 cruises, one to the Faeroe-Shetland-Channel in the North Atlantic (July 1999) and one in the North Sea in August/September 1999. This research was funded by a grant from the EU-TMR and the Austrian Bureau for Foreign Studies.

Bacterioplankton incorporated about 55 % of ^{14}C-labeled glucose-C into intracellular and 45 % into capsular material. No significant difference was found between P-limited and balanced nutrient conditions. Bacteria readily released radiolabeled DOC into the ambient water at a rate of ? 15 amol C $cell^{-1}$ h^{-1} which amounts to about 25 % of the respired C. Thus, we have evidence that bacterioplankton are constantly renewing parts of the capsule and releasing parts of it into the ambient water. The capability of this bacterial-derived capsular DOC to coagulate to



The negative staining technique to visualize the bacterioplankton capsule using Congo Red and Maneval's stain. The dense capsule becomes visible as a white (unstained) halo around the stained bacterium. Black and white arrows indicate examples of capsulated and non-capsulated bacteria, respectively. Typical examples are shown (a) for a nutrient-enriched seawater culture and (b) for the water column of the North Sea (sampling depth 20 m).



Depth profiles of bacterial abundance and the percentage capsulated bacteria and the bacterial production, expressed in µg C l^{-1} determined by thymidine (TdR) and leucine (Leu) incorporation in the Faeroe-Shetland-Channel (a) shelf water, (b) frontal system, and (c) open oceanic water. Symbols represent the means ± SD of at least 4 sampling sites at the specific depths (each sampling site was sampled 1-5 times).

exopolymer particles was determined. Under high turbulence, larger but fewer polysaccharidic particles (>2 µm in diameter) were formed, while the total exopolymer particle mass (>0.2 µm) was higher under stagnant conditions. Under stagnant conditions, most of the bacterial-derived particles remained in the size-class between 0.2 µm and 2 µm. The production rate of exopolymer particles was estimated to amount to about 4 amol C $cell^{-1}$ h^{-1}, representing about 25 % of the estimated bacterioplankton DOC release of about 15 amol C $cell^{-1}$ h^{-1}.

Bacterioplankton utilization of bacterial-derived DOC was 4 orders of magnitude lower than the utilization of glucose; incorporation of bacterial-derived DOC was detectable only when inorganic nutrients were added. Based on these experiments, it was concluded that bacterial-derived DOC is rather refractory. A method to determine the number of capsulated bacteria by light microscopy was developed in order to determine the contribution of capsule-bearing bacteria to the total bacterial community. We found that more than 95 % of the capsulated bacteria were metabolically active. Grazing of flagellates on capsulated and therefore metabolically active bacteria was 2 - 4 times higher than on non-capsulated bacteria, independent of the size of the bacteria. The contribution of capsulated bacteria to the total bacterial abundance increased in the absence of flagellates during the course of the incubation while in the presence of flagellates the number of capsulated bacteria declined.

Generally, capsulated bacteria are more abundant in eutrophic surface waters than in deeper or more oligotrophic waters. In the upper 100 m of the water column of the North Atlantic,

about 6-14 % of the total bacterioplankton community was capsulated, while in the layers below 100 m depth, 97 % of the bacteria lacked a visible capsule. The percentage of capsulated bacteria correlated with bacterial abundance, bacterial production and chlorophyll *a* concentration. In the North Sea, the contribution of capsulated bacteria to the total bacterial community decreased significantly from 19.6 % at the surface (0-3 m) to 14.4 % in the bottom layer (25-35 m). In the nearshore areas of the North Sea about 27 % of the bacteria exhibited a capsule.

We conclude that capsulated bacteria are metabolically active and release copious amounts of organic carbon into the ambient water. A release rate of capsular material of ? 25 % of the bacterial respiration rate together with the refractory nature of the bacterial-derived DOC led us to suggest that a considerable portion of the oceanic carbon pool consists of bacterial-derived, refractory organic carbon. The release of the capsule into the ambient water when bacteria enter the dormant stage (become inactive) may be a survival strategy of marine bacterioplankton to reduce grazing pressure by flagellates.

EXTERNAL PROJECTS OF THE DEPARTMENT OF BIOLOGICAL OCEANOGRAPHY

- Role of non-phytoplankton food for zooplankton in the North Sea. (ALW- NWO).
  M.A. Baars
- Indicators for zooplankton diversity in the North Sea (GONZ2000, RIKZ).
  H.G. Fransz
- Mass transfer and ecosystem response (MATER, EU-MAST III).
  G.J. Herndl
- Canary Islands Azores Gibraltar Observations (CANIGO, EU-MAST III).
  G.J. Herndl
- The chemical composition and reactivity of bacterially derived dissolved organic carbon (DOC) and its contribution to the bulk oceanic DOC pool (ALW-NWO).
  G.J. Herndl
- Ecological role and diversity of planktonic bacteriophages in the North Sea and the Wadden Sea. (ALW-NWO).
  G.J. Herndl
- Bacterioplankton exopolymer production, exopolymer reactivity and contribution to the oceanic dissolved organic carbon pool (EU-TMR-Environment and Climate).
  G.J. Herndl
- Role of ultraviolet radiation on the interaction between phytoplankton, dissolved organic matter and bacterioplankton (EU-TMR-MAST III).
  G.J. Herndl
- Composition of dissolved organic matter and its interaction with metals and ultraviolet radiation in river-ocean systems: impact on the microbial food web (COMET, 5th FWP of the EU).
  Coordinator: G.J. Herndl
- Role of microbial mats in bioremediation of hydrocarbon polluted coastal zones. (MATBIOPOL, 5th FWP of the EU).
  G. Muyzer
- Chemical fossils of diatoms for age determination of petroleum: Improved tools for solving exploration and production problems. (STW-NWO).
  G. Muyzer, J.S. Sinninghe Damsté, S. Schouten.
- A historical molecular record of Holocene environmental changes from Antarctic sediments of stratified fjords and lakes (NAP-NWO).
  G. Muyzer, J.S. Sinninghe Damsté, S. Schouten.
- Preparation and integration of analysis tool towards operational forecast of nutrients in estuaries of European rivers (PIONEER, EU-MAST III).
  P. Ruardij
- GEMSED: adaptation and preparation of ERSEM Benthic Nutrient Mode for use as submodel in a model suited for the modelling environment of WL (DELWAQ, wl-Delft Hydraulics)
  P. Ruardij
- The linkage between nano/picoplankton production and reef cryptic fauna: a key process in degrading reefs? (WOTRO).
  F.C. van Duyl, R.P.M. Bak
- Biological control of harmful algal blooms in European coastal waters: role of eutrophication (BIOHAB, 5th FWP of the EU).
  Coordinator: M.J.W. Veldhuis

DEPARTMENT OF MARINE ECOLOGY

The Department of Marine Ecology mainly works on individuals and populations/communities of larger organisms living in benthic marine systems. Much emphasis is put on marine macro-benthic invertebrates and their vertebrate predators.

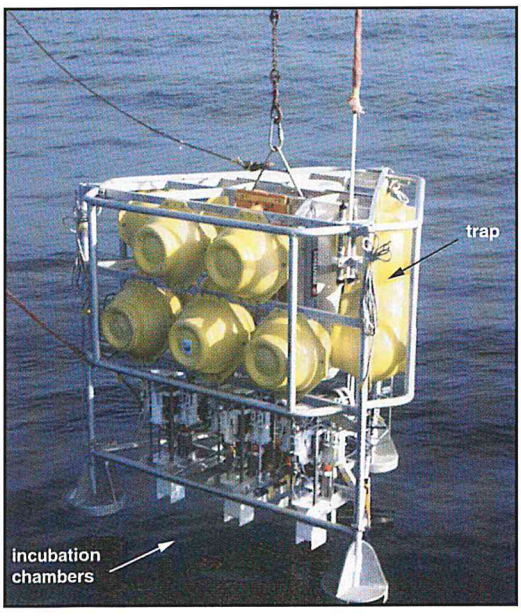
Work in intertidal areas aims to link the behaviour of individuals to the structure and dynamics of populations. The key study system is the intertidal soft-sediment community, and most attention focuses on the Wadden Sea. Research topics are, for example, the foraging behaviour of shorebirds and crabs, predator avoidance mechanisms of bivalves, spatial patterns in flatfish abundance, and the impact of food availability and predation on settlement success of bivalves. Work in shelf seas (mainly the North Sea) and on the shelf edge aims at an understanding of the temporal fluctuations in abundance and spatial distribution of macrobenthos populations. It emphasises the role of food in determining these distributions, for example by relating the magnitude and quality of the food particle flux with the performance of individual organisms in terms of, for example, growth and fecundity. Tropical coral reef studies (mainly in the Caribbean) aim at understanding changes in these high biodiversity communities in relation to water quality.

This year an internal profile committee evaluated the research of the department and suggested a common theme for the department. The theme might be formulated as trying to understand the relative role of food input and predation in structuring macrobenthic communities of soft-sediment habitats, ranging from the shelf margin to the intertidal. Research methods to be followed are (1) observations, particularly long-term (and wide range) surveys; (2) manipulative field experiments, e.g. using new lander technology; (3) laboratory experiments, e.g. using the experimental large-scale tidal facilities; and (4) modelling. At present much expertise is available within the department to support this theme. The topic of predation is well represented, both concerning observational field studies, laboratory experiments and (statistical) modelling. The same is true for expertise on the application of lander technology at the seafloor and the characterisation of food input. Experimental work at the community level should be extended (at present much attention is focused on the more descriptive approach through long-term surveys), both in the intertidal and subtidal areas.

The NIOZ offers excellent possibilities for co-operation with other disciplines and the theme will come to full advantage if the expertise of the other departments of the NIOZ is sought. The assessment of food input and the characterisation of food quality, for example, may strongly benefit from co-operation with the departments of Marine Chemistry and Geology and Marine Biogeochemistry and Toxicology. The theme is closely related to more general questions, as for example on the relation between community structure and ecosystem characteristics. Co-operation with others is required, when the role of macrobenthos species for ecosystem properties (Marine Chemistry and Geology, Biological Oceanography) or the relationships between benthos and near-bed sediment hydrodynamics (Physics) are considered.

OCEAN MARGIN EXCHANGE PROGRAM (OMEX-II-II)

Contributors: *Gerard Duineveld, Marc Lavaleye*



The objective of the EU-funded OMEX-II-II program (1997-2000) was to study exchange processes at the steep continental margin of the NE Iberian peninsula. In contrast to the OMEX-I (1993-1996) target area, the Goban Spur west of Ireland, the NW Iberian margin is characterized by coastal upwelling with offshore filaments. In the framework of OMEX-II we have studied the metabolic activity and structure of the benthic communities on the slope and adjacent abyssal plain in search for evidence of upwelling enrichment. The evidence we sought were deviations from the normal depth-related trends, e.g. a decrease of numbers and biomass of benthic animals with depth. We focused our benthic study on megafauna since these larger organisms have been shown to exhibit a strong response to gradients in food quality and quantity across the slope. Because of their relatively long life span, megafauna also give an integrated picture of the availability of food. The respiratory activity of the whole sediment community was measured using a new ALBEX lander which is designed for long-term deployments (months) and repetitive incubation experiments. Special features of this lander include NIOZ built optical oxygen sensors (optrodes), and a sediment trap with an internal fluorometer.

ALBEX lander with three independent incubation chambers and sediment trap with internal fluorometer.

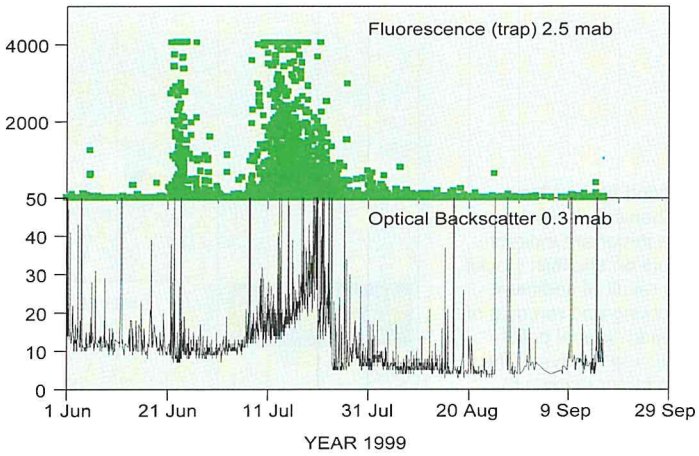
The megafauna between 200 and 1500 m depth on the Iberian Margin off La Coruña is dominated by filter-feeding species arranged in a marked depth zonation. The shelf break is densely populated with crinoids which are abruptly replaced by Pennatulacea downslope. Still deeper the slope is successively dominated by solitary scleractinians (*Flabellum macandrewi*, 700m), reef-forming cold-water corals (*Lophelia pertusa*, 1000m), and by tiny colonial Zoanthinarians (1400 m). The video records from the upper slope showed current ripples everywhere and in some places mega-ripples as well. These combined data indicate that the Iberian upper slope is a non-depositional, high energy environment.

Left hand frame with crinoids at the shelf break (~200m). Note the turbid conditions. Right hand frame taken at 700 m depth with scattered solitory corals (*Flabellum*) and a gadoid fish.

This conclusion is confirmed by low concentration of sedimentary pigments and DNA. A change to more quiescent conditions was observed at the mid slope depth (2200 m) where deposit- feeding sea urchins (Irregularia) dominated the megafauna and burrows and traces are preserved in the surface sediment. These features become more explicit at the abyssal plain (4900 m) that has a megafauna dominated by deposit-feeding holothurians and a sediment surface with numerous burrows, traces and faecal casts. Unexpectedly, the abyssal sediment yielded the highest concentrations of chlorophyll and (diatomaceous) pigments of all samples taken across the Iberian slope. Megafauna biomass on the Iberian margin was in the range of the Goban Spur but on average lower.

Left hand frame showing patch of the colonial coral *Lophelia pertusa* at 1000 m. Right hand frame showing the numerous biogenic structures on the abyssal plain (4900 m) which is covered by a green veneer.

Two six-month deployments (May-September 1998 and 1999) of the ALBEX lander at 2200m depth off Vigo yielded a narrow range of oxygen uptake rates with an average of 0.76 (± 0.18) mmol O_2 m^{-2} d^{-1}. This average figure is very close to the value measured in-situ at 2200 m during OMEX-I at the Goban Spur slope where no coastal upwelling occurs. In early summer 1999 the sediment trap on the ALBEX lander recorded a short but strong pulse of phytodetritus, the remains of which were resuspended a few weeks later. Because of the short residence time of this pulse and possibly its low initial reactivity, we did not record a metabolic response by the sediment community to the pulse. In conclusion, our combined measurements did not show an effect of the coastal upwelling on the slope communities. However, the abyssal plain adjoining the steep slope receives a substantial input of phytodetritus possibly from export of coastal upwelling or alternatively, and more likely because of the high sediment chlorophyll-a concentrations, from offshore blooms.

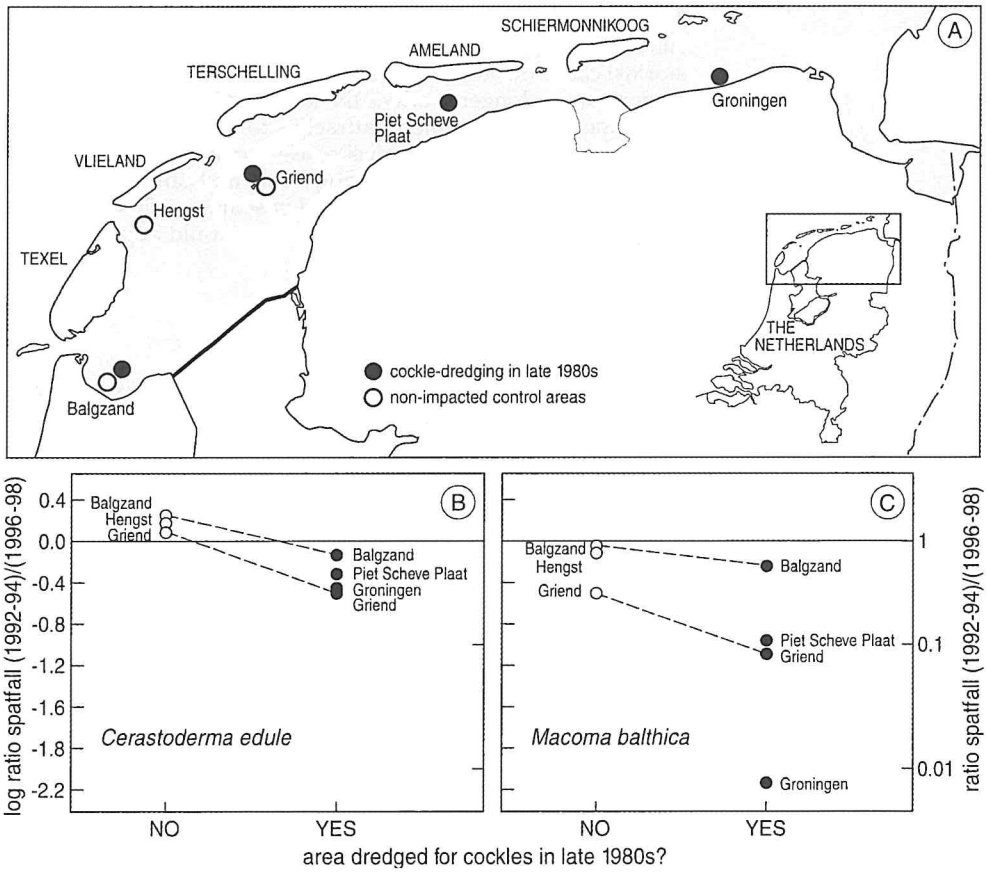


Upper panel shows fluorescence record of particles caught by the sediment trap mounten on the ALBEX lander. Lower panel shows record of an Optical Backscatter Sensor suspended 0.3 m above the bottom.

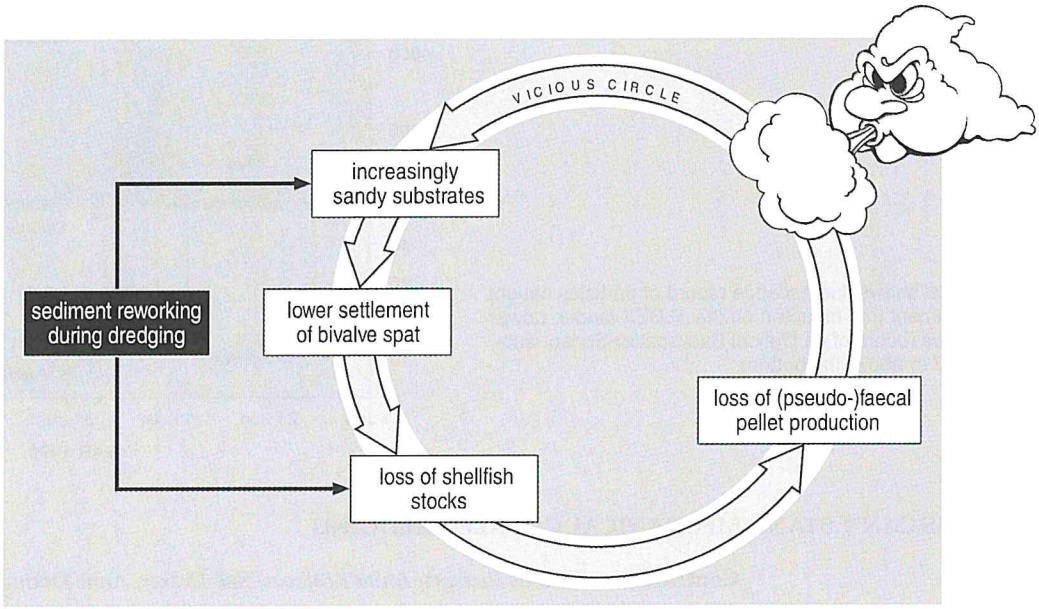
COCKLES CAN'T STAND MECHANICAL COCKLE-DREDGING

Contributors: *Theunis Piersma, Anita Koolhaas, Rob Dekker, Anne Dekinga, Jan J. Beukema*

There is widespread concern that many forms of bottom-fisheries damage the epi- and infaunal communities of intertidal and subtidal sediments. Bottom-fisheries not only remove the target species, but also impact on associated flora and fauna. In addition, trawling, dredging and digging usually remove biogenic structures on the surface that are not easily replaced, such as musselbeds, or banks of tube-living polychaetes, even when such elements are not the target of the fisheries. Depending on the scale of the fisheries and the local hydrological conditions, these effects on non-target organisms or structures – often responsible for key benthic processes – may also lead to changes in sediment characteristics. Recovery is usually very slow and benthic communities may remain in a substantially altered state afterwards.



(First figure:) Comparison of spatfall of *Cerastoderma edule* (B) and *Macoma balthica* (C) just after the cockle-dredging events in the 1988-1990 period (average spatfall densities in 1992-1994) and somewhat later in time (1996-1998) on five different intertidal flat areas in the Dutch Wadden Sea (A) that were either or not exposed to cockle-dredging. None of the study sites was dredged for cockles between 1990 and 1998. Two of the areas (Griend and Balgzand) contained a fished and a non-fished part and these data points are connected by dashed lines.



(Second figure:) How mechanical shellfisheries have important indirect effects on shellfish stocks as a result of sediment reworking and removal of (pseudo-)faecal pellet producing bivalves. The main factor leading to lower bivalve stocks are the increasingly sandy substrates that lead to decreasing rates of bivalve settlement. Winter storms are thought to increase the strength of this negative feedback loop.

In autumn 1988, many parts of the Dutch Wadden Sea were suction-dredged for edible cockles *Cerastoderma edule* that were not fished since. Together with colleagues from the National Institute for Coastal Research (RIKZ), we determined average spatfall densities of cockles and Baltic tellins *Macoma balthica* in the short (1992-1994) and the medium term (1996-1998) after cockle-dredging, in several fished and unfished areas. We then calculated the ratio of the two for each location. Log-transformed ratios are normally distributed and thus differences between fished and unfished areas are easily tested for significance by Student's *t*-tests. There appeared to be a significant negative effect of dredging on subsequent settlement of *Cerastoderma*. A similar effect for *Macoma* was not statistically significant.

We conclude that cockle-dredging has long-lasting effects on the Wadden Sea intertidal. The causal chain that makes single dredging events having such long-term consequences may run as follows. Initially, sediment reworking by suction-dredging (especially during autumn storms) cause the loss of fine silts. The disappearance of *Cerastoderma* means that these filter feeders can no longer produce the faecal pellets that play such an important role in the build-up of fine-grained sediments attractive to settling bivalves. A negative feedback loop is established. At least at the dredged site near Griend, a reversal of sedimentary characteristics occurred from 1995 to 1996, during a cold and calm winter season. The absence of major storms may well have triggered the reversal in sediment characteristics and bivalve settlement. Thus, any recovery of mechanically fished areas would depend greatly on chance conditions such as the incidence of winter storms.

EXTERNAL PROJECTS OF THE DEPARTMENT OF MARINE ECOLOGY

- Shorebird flyways and intertidal benthic communities (NWO-PIONIER)
  T. Piersma, J. van der Meer, W.M.C. Edelaar, J. van Gils, P. Luttikhuizen, A. Dekinga
- Differentation in Caribbian reef-building coral populations (NWO)
  R.P.M. Bak, O. Diekman
- Population dynamics of groupers (Serannidae) at Banten Bay; Coral community dynamics of an Indonesian coral reef under stress; and Population dynamics of some selected bird species, their food requirements and the changing environment - Teluk Banten II (NWO)
  H.J. Lindeboom, R.P.M. Bak, E.H. Meesters, Yus Rusila Noor, Siti Nuraini
- Dynamics through natural and anthropogenic causes of marine organisms: effects of large scale ecological changes on fish and fisheries (EU)
  H.J. Lindeboom, C.J.M. Philippart, C. Winter, J.W. De Leeuw, J.J. Beukema, J. Van Der Meer
- Damage of coral reefs by recreational activities: Strategies and the development of novel markers for environmental stress (EU)
  R.P.M. Bak, G. Nieuwland
- Autonomous lander instrument packages for oceanographic research (EU)
  G.C.A. Duineveld, E. Berghuis, R. Witbaard
- Ocean margin exchange II (EU)
  G.C.A. Duineveld, E. Berghuis, A. Kok, J. Van Der Weele, M. Lavaleye, P.A.W.J. De Wilde

- Biological monitoring programme North Sea and Outer Delta (RWS)
  R. Daan, M. Mulder
- Biological monitoring programme macrozoöbenthos, Wadden Sea, Balgzand and Ems-Dollard (RWS)
  R. Dekker
- Sampling and analyses of larger benthic organisms near dredge dump sites in the North Sea. (RIKZ)
  M.J.N. Bergman, R. Daan
- Effects of climate change on reproduction of intertidal bivalves (NOP II)
  J.J. Beukema, T. Piersma, J. van der Meer, J. Drent
- Limiting the ecological effects of beamtrawl gears; REDUCE (EU)
  M.J.N. Bergman, M. Fonds, S. Groenewold
- Parameters for Ecosystem Quality in the North Sea (GONZ-II)
  H.J. Lindeboom, C.J.M. Philippart, M. Lavaleye
- The tree of the sea: climate reconstructions on basis of the bivalve Arctica islandica (CLIVARNET)
  J. van der Meer, H.J. Lindeboom, R. Witbaard
- Decadal variability in marine ecosystems and climate history in corals.
  J. van der Meer, H.J. Lindeboom, C.J.M. Philippart, R.P.M. Bak, C. Meyer
- Sustainable use and management of marine ecosystems.
  J. van der Meer, C.J.M. Philippart, O. Bos
- Birds and macrofauna, A prewstudy for E.I.A.-O4, (Oranjewoud).
  C.J. Camphuijsen, M. Lavaleye
- Ecosystem targets in the North Sea (LNV).
  H.J. Lindeboom, M. Lavaleye, H. Van Der Veer
- Benthos Western Wadden Sea (Waddenvereniging).
  T.L. Piersma, C. Raaymakers, A. Koolhaas
- Interactions between the marine environment, predators and prey, IMPRESS (EU).
  J. Van Der Meer, C.J. Camphuijsen
- Species environment relationships and the implications of scale (RWS)
  J. van der Meer
- Interference and the spatial distribution of shorecrabs (ALW)
  J. van der Meer, I. Smallegange
- Functional ecology of preen-gland waxes (ALW)
  T. Piersma, J. Reneeskens
- Long-term trends in fike catches
  H. van der Veer
- Beam-trawl nets
- H van der Veer
- Restoration nursery function Westerschelde (RWS)
  H van der Veer
- Ecological consequences of Maasvlakte extension
  H van der Veer
- Review Fifth Framework proposals (EU)
  H. van der Veer
- Benthos Roebuck Bay (National Geographic)
  T. Piersma, B. Spaans, A. Dekinga
- Deep-water corals Aces (EU)
  G. Duineveld, M. Lavaleye
- Food reservation and shellfisheries (Alterra)
  J. van der Meer
- Ecotypes (Alterra)
  J. van der Meer
- Flatfish Symposium
  H. van der Veer
- Key processes in degrading reefs (NWO)
  R.P.M. Bak, S. Scheffers

(*Overdruk uit: Tijdschrift der Ned. Dierk. Ver.* (2). *VII.* (2).

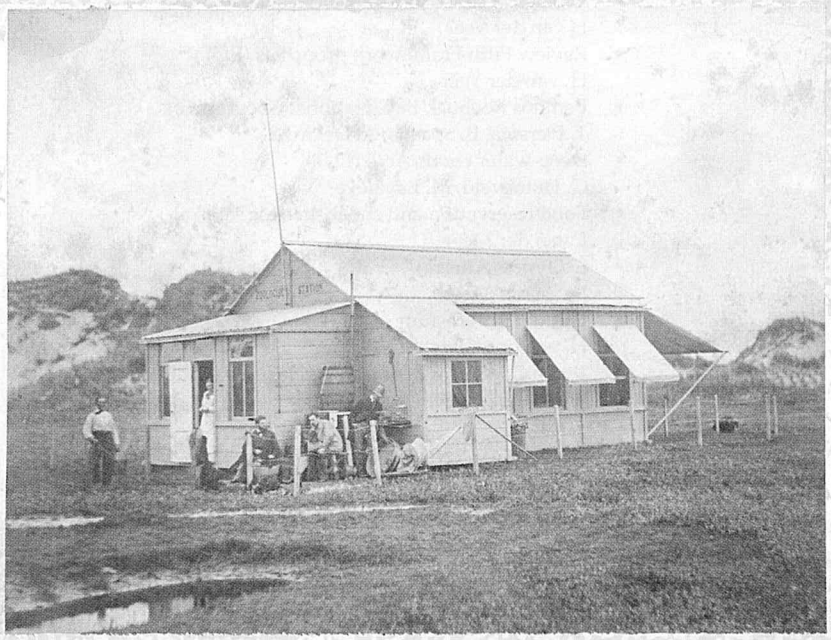
HET ZOÖLOGISCH STATION

DER

NEDERLANDSCHE DIERKUNDIGE VEREENIGING

in 1900

Wat ik U omtrent de geschiedenis van het Zoölogisch Station gedurende het jaar 1900 heb mede te deelen, bepaalt zich bijna geheel tot het vermelden van de personen, die het Station bezocht hebben en tot de opgave van hetgeen daar door hen werd verricht. Van het gebouw, het houten bijgebouwtje, dat als bergplaats voor het vischtuig enz. dienst doet, het terrein, dat grootendeels als tuin is aangelegd, kan ik alleen herhalen, wat ook dienaangaande in vroegere verslagen werd opgenomen: een en ander wordt met zoo grooten zorg, als de middelen maar veroorloven, onderhouden en bevindt zich dan ook over 't algemeen in goeden staat. Dat geldt ook voor den inventaris, die ieder jaar wordt nagegaan en met het noodzakelijkste wordt aangevuld. De lijsten van den inventaris werden om- en bijgewerkt en in eenigszins anderen vorm — de afzonderlijke artikelen op losse stroken en deze tot rubrieken vereenigd — opgesteld en in gereedheid gebracht.



The initial movable zoological station here placed at Terschelling, 1879.

Het ondergeschikte personeel — de bediende, die sedert 1889 aan het Station werkzaam is en de tweede bediende, die wij nu sedert 1895 hebben — gaf bij voortduring reden tot tevredenheid. Voor twee volwassen personen is er echter in den regel geen werk genoeg in onze instelling. Ik hoop er dan ook in den loop van dit jaar in te slagen den tweeden bediende, die nu den 19 jarigen leeftijd bereikt heeft, wien echter niet meer dan een loopjongens- of leerlings-weekgeld kan worden uitbetaald, op andere wijze voort te helpen. Dan stel ik mij voor in zijn plaats wederom een jong maatje aan het Station te verbinden.

Ter aanvulling van het relaas, omtrent hetgeen in 1900 in het Station werd verricht, dient ten slotte nog vermeld te worden, dat de Heer Redeke zijne onderzoekingen omtrent de anatomie van de Selachiers voortzette en in het Tijdschrift der Vereeniging daarover een klein opstel publiceerde *), dat hij mij bij verschillende onderzoekingen assisteerde en met het bewerken van het plankton, dat bij gelegenheid van het oesteronderzoek op de Oosterschelde verzameld wordt, een aanvang maakte. Dan was hij mij in het laboratorium, zoowel als op het onderzoekingsterrein, behulpzaam bij dat onderzoek, en evenzoo bij een aantal waarnemingen, die door mij in Duitschland op den bovenstroomloop van den Rijn werden ingesteld en die op de levenswijze van de jonge, de voortplanting van de volwassen zalmen betrekking hadden. Over die waarnemingen verscheen dezer dagen in de Nederlandsche Staats-Courant een rapport *), waarnaar ik de belangstellenden meen te mogen verwijzen. En wat de in de laatste jaren door mij ingestelde oesteronderzoekingen betreft, zoo houd ik mij met het samenstellen van het verslag dienaangaande bezig en reken ik dit in ieder geval in den loop van het jaar 1901 te zullen afsluiten en te mogen openbaar maken.

Omtrent de geldmiddelen van het Zoölogisch Station kan ten slotte nog worden medegedeeld, dat de uitgaven in 1900 met een bedrag van $f 2039.33^5$ gedekt zijn geworden. Dit zijn natuurlijk uitsluitend de uitgaven, die op de exploitatie, op het gebruik van het Station betrekking hebben; zij maken uit den aard der zaak deel uit van de uitgaven der Vereeniging, omtrent welke door den Penningmeester reeds Rekening en Verantwoording werd afgelegd.

THE NETHERLANDS MARINE RESEARCH FACILITIES (MRF)

Contributor: *Marieke J. Rietveld*

MRF advises the Earth and Life Sciences Board (GB-ALW) of NWO on the technical, logistic and financial aspects of the execution of the National Programme for sea research. When sea-going projects have been approved and granted by GB-ALW, MRF helps the chief scientists in the planning, preparation and execution of the cruises. MRF also advises GB-ALW on long-term investments, in consultation with the financial department and technical services of NIOZ and advisory committees ('GAG's') on CTD systems, Auto-analyser systems, Moored instrumentation systems, Bottom sampling and seismic systems and Biological sampling systems. In these advisory committees scientists and technicians from all Dutch scientific groups involved in sea-going research participate.

In 2000 discussions with NWO on the new organisational structure of MRF were concluded. NIOZ-MRF already proceeded as off early 2000 in accordance with the new structure. Early 2001 NWO will install the new Advisory Committee for Marine Facilities (ACMF).

This year the National Programme consisted of:

1. Mixing of Agulhas Rings Experiment (MARE). The CLIVARNET programme MARE studied the Agulhas eddies in the Benguela current, and their climatological impact on the North Atlantic Deep Water. The research area is 25-40°S and 0-20°E (between Walvis Ridge and Agulhas Bank). The MARE programme consists of five parts, each with its own P.I. The field work in 2000 was done during three cruises. The first two cruises were part of the Pelagia Around Africa 2000 programme and took place in February-March. The third was executed in August on the South African research ship S.A. Agulhas that was chartered from the South African Government. MARE is a co-operation between IMAU (coordinator), NIOZ and the University of Cape Town. Project manager was prof.dr. W.P.M. de Ruijter, Utrecht University. Chief scientists were Dr. G.J. Brummer and Drs. C. Veth (NIOZ).
2. Palaeoceanographic, Palaeoclimatic, Palaeo-environmental and diagenetic Aspects of Sapropel formation in the Eastern Mediterranean with emphasis on the most recent S1 (PASS-2). Project manager and chief scientist was Dr. G.J. de Lange, Institute of Earth Sciences, Utrecht University. The project is the sea-going contribution to the EU-programme Sapropels and Paleoceanography (SAP). The overall aim is a better understanding of the (paleo) functioning of the Eastern Mediterranean and to determine the role in the global environment by studying the characteristic biogeochemical processes. Field work on board R.V. Pelagia took place as part of the Pelagia Around Africa Programme 2000 in May.
3. PLUME & BLOOM, the Role of non-phytoplankton food for zooplankton in the North Sea. Project manager and chief scientist was Dr. M. Baars (NIOZ). This new multidisciplinary Frisian Front programme concentrates on both the nutrient, turbidity and plankton dynamics in the East Anglian Waters as well as on the resulting blooms and secondary pelagic consumption and production downstream over the Frisian Front. Two 12-day research cruises, and an additonal 10-day cruise, spread over different seasons were carried out on board R.V. Pelagia; in July, September and November. From the 2001 cruise programme a six-day cruise was executed in December 2000.
4. Clivarnet Atlantic Monitoring Programme (CAMP), the NIOZ contribution to the CLIVARNET programme. Project manager and chief scientist Dr. H.M. van Aken (NIOZ). A bi-annual hydrographic survey with R.V. Pelagia along a section between Ireland and Greenland to monitor climate related inter-annual variations. A 26-day cruise was held from end of September – end of October.

The Scanfish during Plume & Bloom
Photo: S. Gonzales.

Advice to GB-ALW for the National Programme 2001:

For the outstanding cruises for 2001 for the CLIVARNET programme MARE (programme manager Prof.dr. W.P.M. de Ruijter, UU-IMAU), PASS-2 (project manager Dr. G.J. de Lange, UU-IvA), and for the ACSEX-II project (project manager prof.dr. W.P.M. de Ruijter, UU-IMAU), MRF again advised the use of R.V. Pelagia in a second Around Africa programme: "Pelagia Around Africa 2001". This major cruise in which R.V. Pelagia makes again a circumvoyage around Africa can be achieved due to the combination with several other projects during transit and in underway trajects in the North and South Atlantic, the Indian Ocean, and the Eastern Mediterranean. These additional projects will be financed by NIOZ and external sources.

For the CANOBA project (The continental shelf pump: a pilot study in the North Sea; project manager Dr. H. Thomas, NIOZ)) the use of R.V. Pelagia was advised for two cruises in the North Sea.

For the EMIR project (Enhanced Carbon Mineralisation rates in permeable sandy sediments) (project manager Dr. W. Van Raaphorst) The use of R.V. Pelagia was advised for one cruise in the Southern North Sea.

For the continuation of the project PLUME & BLOOM (project manager Dr. M. Baars, NIOZ) again the use of R.V. Pelagia was advised for two cruises in the Southern North Sea. The possibility to use the UK R.V. Corystes for an early Spring cruise will be explored.

For the 2002 National Programme MRF advised GB-ALW on four high ranking sea-going proposals (three NIOZ, one NIOO-CEMO) of a total of ten proposals with a sea-going component.

M.J. Rietveld, member and acting secretary ISOM, as well as this year's chair, was the convenor and organizer of the 14th meeting of the International research Ship Operators Meeting (ISOM), at the Royal Academy of Arts and Sciences (KNAW) in Amsterdam, the Netherlands. The ISOM delegates visited the NIOZ institute and Marine Facilities.

NIOZ organized the 3rd International Marine Technicians Workshop (INMARTECH), an initiative of ISOM, that was held at NIOZ from 20 – 22 September 2000.

The total effort in terms of ship days and personnel involved in 2000 is given in the table below.

Project		ship days	scientists	students	MRF	others
1	MARE					
	1. MARE-0	11	7	3	4	1
	2. MARE-1	30.5	6	4	5	
	3. MARE-2	25	12	6	8	
2	PASS-2	31	12	6	5	
3	PLUME&BLOOM	42	10	3	2	
4	CAMP	25	4	3	3	
Total		162.5	51	25	27	1

DATA MANAGEMENT GROUP

Contributors: *T.F. de Bruin, R.X de Koster, M.A. Hiehle, J. Nieuwenhuis, H. Ridderinkhof*

The Data Management Group (DMG) is a separate group within the department of Physical Oceanography, funded by ALW and NIOZ.
It has a national role as data centre for the academic oceanographic community. It also acts as National Antarctic Data Centre (NADC).

The main tasks of the DMG are to:
- assist scientists during all phases of a project with data handling
- archive and keep available all relevant data of ALW and NIOZ' cruises.

The importance of the Internet as a means to transfer data and information is reflected by the emphasis the DMG has put on web development. The DMG maintains a series of databases and project web sites. Part of these are dynamically linked.

In the first half of 2000 the DMG was strongly involved in the 'Around Africa'-expedition. A dedicated web site with near real-time information from the research vessel Pelagia was developed. Part of the ensuing Public Relations and contacts with the press, was handled by DMG. During the Around Africa expedition the DMG assisted the scientists onboard with the delivery and interpretation of remote sensing data and other information. A refurbished 'Around Africa 2001' web site was prepared at the end of 2000.

Apart from the Around Africa web site, web sites for the Biological Control of Harmful Algal Bloom (BIOHAB), Harmful Impact Communication of TBT (HIC-TBT) and Agulhas Current Sources Experiment (ACSEX) projects were added to the growing list of project web sites in 2000. Many of these web sites are dynamically linked to FTP areas, permitting easy data exchange amongst participants of a particular project.

All relevant digital data, collected during the Pelagia cruises, have been archived on CD-ROM and are stored in a safe, for use in case of an emergency. Dedicated software for archiving these CD-ROMs was already operational and has been further refined.

Staff of the DMG participated in three cruises, notably in the MARE-1-, ACSEX- and CAMP cruises. Part of the post processing of the CTD data for these and other cruises, was carried out by the DMG.

The DMG noticed an increasing usage of the relational database as a research tool in 2000. Though some scientists still consider a relational database to be just a large collection of ordered data, an increasing number are becoming aware of the potential of a relational database as a research tool.

This can be illustrated by the following example: For a study on the existence of a varying oxygen maximum ('breathing ocean'), it was needed to find values of the oxygen maximum and its corresponding depth as a function of time and at a constant potential density. The 'manual' approach would have taken many days. The SQL statement to extract the data from the database took less then 1.5 seconds to execute, with a much better accuracy than the manual approach.

The DMG represents NIOZ and the Dutch academic oceanographic community within the National Oceanographic Data Committee (NODC). The data manager is the NODC Secretary.

Furthermore, web sites for the secretariats of the NODC and the International Research Ship Operators' Meeting (ISOM) are maintained by the DMG.

An additional task of the DMG is the development and maintenance of the Netherlands Antarctic Data Inventory (NADI, http://www.nioz.nl/projects/antarctica) for the Antarctic research projects in the Netherlands. In 2000 over 40 % of all Antarctic projects with a data component, were added to the NADI database. One member of the staff represented the Netherlands at the annual meeting of the Joint Committee on Antarctic Data Management (JCADM).

An international workshop to improve the National Antarctic Data Centre guidelines and the JCADM web site, was hosted by the DMG in October.

THE EDITORIAL OFFICE OF THE JOURNAL OF SEA RESEARCH

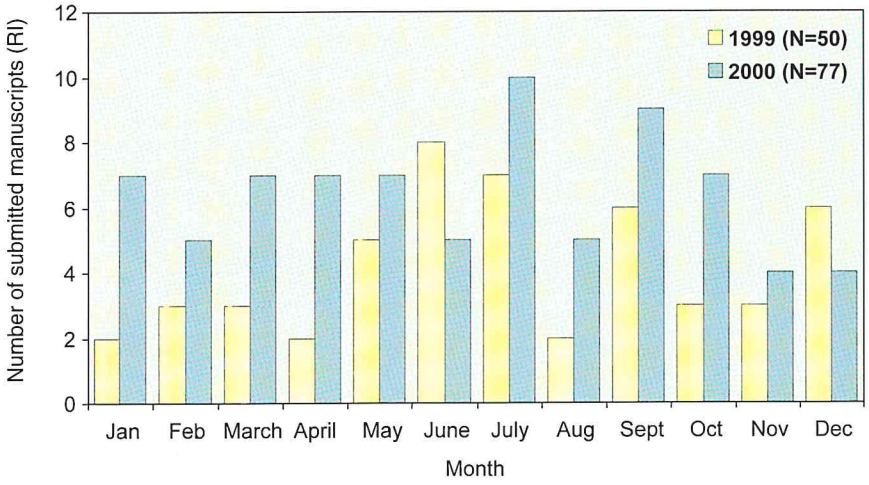
C.J.M. Philippart, J.J. Beukema, G.C. Cadée, W. van Raaphorst, B. Bak-Gade

In April 1961, the greatly expanding activities of the NIOZ induced the Netherlands Zoological Society to issue a new journal, the Netherlands Journal of Sea Research (NJSR). After a change in name (JSR) in 1996, and publication by Elsevier since 1997, the journal published its 43rd and 44th volumes in 2000. Upon the retirement of J.J. Beukema, C.J.M. Philippart has been appointed editor-in-chief as of 1 May 2000. Fortunately, J.J. Beukema will still be fully active as a regular editor of the JSR for the coming years.

Home countries of first authors of the 50 papers published in the Journal of Sea Research, in 2000 (Volumes 43 and 44).

In 2000, the Journal published four regular issues and two double special issues, together comprising 50 papers. It is noteworthy that the first authors of these 50 papers come from all over the world. Although most authors originate from European institutes and universities, a substantial number comes from the US, Canada and the Australian continent. The first special issue (Vol. 43 – Nos. 3-4) contained the Proceedings of two consecutive symposia on Biological and Environmental Chemistry of DMS(P) and the Role of *Phaeocystis* in Marine Biogeochemical Cycles. The other special issue (Vol. 44 – Nos. 1-2) embodied the first part of the Proceedings of the Fourth International Symposium on Flatfish Ecology. This year, 77 manuscripts were submitted for publication in regular issues, which is ~25% above the average in 1998-1999. The acceptance rate for regular issues was ~44% during 1998-2000.

The coming year, the Journal of Sea Research hopes to celebrate its 40th anniversary by means of an international scientific symposium. The symposium "Food for Thought: structuring factors of shallow marine coastal communities", to be held on Thursday 29 November and Friday 30 November 2001, will be organised by the editorial board of the JSR. The first steps to organise this symposium were taken this year, most particularly the selection of topics and speakers to be invited.



Seasonal dynamics of the number of manuscripts submitted for publication in regular issues (RI) of the Journal of Sea Research in 1999 and 2000.

2. Publications and Presentations

PUBLICATIONS

Dissertations

Blokker P. Structural analysis of resistant polymers in extant algae and ancient sediments. UU, Utrecht: 145 pp.
Buitenhuis, E.T. Interactions between *Emiliania huxleyi* and the dissolved inorganic carbon system. RUG, Groningen: 95 pp.
Groenewold, S. Effects of beam trawl fishery on the food consumption of scavenging epibenthic invertebrates and demersal fish in the southern North Sea. University of Hamburg, Hamburg, Germany: 146 pp.
Höld I.M. Structural analysis of some marine kerogens through a combined chemical and thermal degradation approach. UU, Utrecht: 176 pp.
Megens, L. Isotopic and molecular characterization of particulate organic matter in coastal waters, RUG, Groningen, 160 pp.
Obernosterer, I. Photochemical transformation of dissolved organic matter and its subsequent utilization by marine bacterioplankton. RUG, Groningen: 133pp.
Schoemann, V. On the role of Phaeocystis sp. colonies in the biogeochemical cycles of manganese and iron. Université Libre de Bruxelles, Brussels, Belgium: 115p.
Stoderegger, K. Bacterioplankton exopolymer production and reactivity and contribution to the oceanic dissolved organic carbon pool. University of Vienna, Austria: 113 pp.
Van Der Schrier, G. Aspects of the thermohaline circulation in a simple model. UU, Utrecht: 110 pp.
Van Heemst, J.D.H. Molecular Characterization of Dissolved Organic Matter (DOM) in Seawater. UU, Utrecht: 167pp.

Refereed papers and books

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Bak, R.P.M. Coral Reef Tropical Marine Biology Lecture series, UvA, Amsterdam, January.

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Bett, B.J., D.S.M. Billett, J. Galeron, A.J Gooday, K. Iken, R.S. Lampitt, M.G. Malzone, A.L. Rice, M. Sibuet, M.H. Thurston, A. Vanreusel, B.D. Wigham, R. Witbaard & G.A. Wolff. The consequences of the long-term change in megafauna for benthic community dynamics and sediment geochemistry at the Porcupine Abyssal Plain. 9th Deep Sea Biology symposium, Galway, Ireland, 25-30 June.

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Boon, J.P. A general discussion on the feasibility for a ban on the use of TBT-containing antifouling paints by IMO in 2003. Seminar Control of TBT-based antifouling paints for environmental protection, the World Maritime Academy, Malmö, Sweden, 12 September.

Boon, J.P. An overview of the environmental problems of tributyltin (TBT) from anti-fouling paints on ships. Simposium "sobre el impacto de las pinturas biocidas marinas con base TBT sobre las áreas costeras", Huelva, Spain, 2 June.

Boon, J.P. Levels of polybrominated diphenyl ether (PBDE) flame retardants along the Dutch coast as derived from their accumulation in SPMDs and blue mussels (*Mytilus edulis*). Dioxin 2000 Symposium, 20th Annual Symposium on Dioxins and related compounds, Monterey, U.S.A., 13-17 August.

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Cachão, M., J.R. Young, H. Kinkel, et al. The distribution of the coccolithophore community off Lisbon (Portugal), during June 1999 (CODENET II Cruise): ecological interpretation. INA 8, Bremen, Germany, 11-15 September.

Cadée, G.C. Tropical drift seeds from the Dutch coast. 60 years SWG (Strandwerkgemeenschap) Rotterdam, 7 October.

Camphuysen C.J. European Seabirds at Sea database: what have we learned of systematic, ship-based studies of seabirds in the North Sea. 3. Deutsche See- und Küstenvogelkolloquium, Hermann Ehlers Akademie, Kiel, Germany, 18-19 November 2000.

Camphuysen C.J. Mass mortality of common eiders *Somateria mollissima* in relation to commercial fisheries and fisheries management in the Dutch Wadden Sea. NIOZ, 21 December.

Camphuysen, C.J. Eider mortality in Dutch waters, based on beached bird surveys 1965-2000 (NZG/NSO), with emphasis on the 1999/2000 epizootic. Eider-Workshop NIOZ, 20 April.

Camphuysen, C.J. Eider mortality winter 1999/2000; prey availability, accessibility and quality for molluscivorous birds. NIOZ, 31 May.

Camphuysen, C.J., Cremers, H.J.M., Kats R. & Leopold M.F. Eider dissections; birds collected at Texel (Dutch Waddenzee) during the 1999/2000 epizootic, Eider-Workshop, NIOZ, 20 April.

Croot, P.L. Organic Complexation of Trace Metals: Interactions with phytoplankton from the Skagerrak to the Southern Ocean.– Institut fuer Meereskunde, Univ. Kiel, Kiel, Germany, 9 May.

Croot, P.L. SOIREE – The Southern Ocean Iron RElease Experiment – Limitation and growth in the Southern Ocean. Iron – Cold iron is master of them all,AWI, Bremerhaven, Germany, 13 September.

Croot, P.L., A.R. Bowie & R.D. Frew. Persistence of dissolved iron and Fe^{II} during SOIREE. Southern Ocean – JGOFS Symposium, Brest, France, 6 July.

Croot, P.L., A.R. Bowie, R.D. Frew. Iron Speciation during SOIREE (Southern Ocean Iron Release Experiment), AGU-ASLO Ocean Sciences, San Antonio, USA, 25-28 January.

De Baar, H.J.W. Iron and phytoplankton in the Southern Ocean. Society "Netherlands Nature and Medicine Congres", UvA, Amsterdam, 15 April.

De Baar, H.J.W. Lecture series Introductory Oceanography, Department of Marine Biology, RUG, Groningen, February.

De Baar, H.J.W. Nutrient anomalies of *Fragilariopsis kerguelensis* revisited. Third international symposium on Biogeochemistry of the Southern Ocean, Brest, France, 6 July.

De Baar, H.J.W. The role of iron in plankton blooms and carbon dioxide transfer of the world ocean. International Symposium on German Contributions to the Joint Global Ocean Flux Study, Bremen, Germany, 18-21 September.

De Bruin, T.F. Antarctic datamanagement in the Netherlands. Meeting of the Joint Committee on Antarctic Datamanagement, Tokyo, 10-14 July.

De Goeij, P. Burial decision in an intertidal bivalve. Les Écologistes Seminar Series, Behavioural Ecology Group, Simon Fraser University, Vancouver, Canada, 19 October.

De Goeij, P. The depth of living in *Macoma balthica*, a facultative suspension feeding buried bivalve. Fall Semester Marine Biology Lecture, Bamfield Marine Station, Vancouver Island, Canada, 26 October.

De Goeij, P. Trade-off between feeding and being fed upon in *Macoma balthica*, a burying bivalve. Special Zoology Seminar, University of Washington, Seattle, USA, 16 October.

De Jong, J.T.M., P.L. Croot, & H.J.W. De Baar. Distribution of Iron in the surface and deep waters of the Southern Ocean along 20 W. AGU-ASLO Ocean Sciences, San Antonio, USA, 25-28 January.

De Leeuw, J.W., G.J.M. Versteegh & G. Cini-Castagnoli. Solar-driven climatic change in the Mediterranean over the last 350 years. 5e Nederlands Aardwetenschappelijk Congres, Veldhoven, 20-21 April.

De Stigter, H.C., S. Schmidt & T.C.E. van Weering. Fast sedimentation and sediment transport in the Nazaré Canyon. 32nd Int.Liège Coll. on hydrodynamics. Liége, Belgium, 8-12 May and 3º Simpósio sobre a Margem Continental Ibérica Atlântica, Faro, 25-27 September.

Dekker, R. Quality and quantity of food for Eiders in the western Dutch Wadden Sea: the 1999 situation in a long-term perspective. Eider-Workshop, NIOZ, 20 April.

Edelaar, P. Asset-protection in a burying bivalve. Behavioural Ecology Congress, Zürich, Switzerland, 11 August.

Ens, B.J., A.G. Brinkman & J. Van Der Meer. Predicting the effects of shellfish fisheries, sea level rise and tourism on the waders and waterfowl inhabiting the Wadden Sea. 10th International Scientific Wadden Sea Symposium, 1 November.

Epping, E., A. Khalili, & R. Thar. Photosynthesis and the dynamics of oxygen consumption in a microbial mat as calculated from transient oxygen microprofiles. ASLO aquatic sciences meeting, Copenhagen, Denmark, 5-9 June.

Fransz, H.G. Identification of copepods. Course on identification of marine zooplankton. Zoological Museum, UvA, Amsterdam, 26 September.

Fransz, H.G. Zooplankton diversity and the persistence of *Calanus* populations in the central North Sea, Senckenberg North Sea 2000 symposium, Wilhelmshaven, Germany, 8-12 May.

Gemmrich, J.R. & H. Van Haren. Dynamics of a sloping bottom boundary layer. AGU Ocean Sciences, San Antonio, USA, 24-28 January.

Gemmrich, J.R. Kinetic energy production in the internal wave band. PROVESS Annual Meeting, Grenoble, France, 9-10 March.

Gerkema, T. Internal and interfacial tides. Buys-Ballot Symposium, Kerkrade, 26-27 October.

Gerkema, T. Internal waves: here, there and everywhere. NIOZ, 17 February.

Gerkema, T. Local generation of internal solitons by internal-tide beams. EGS, 25th General Assembly, Nice, France, 25-29 April.

Gerringa, L.J.A., H.J.W. De Baar, R.F. Nolting & P.Croot. The influence of salinity on the solubility of sulphides of Zn and Cd in estuaries, with the Scheldt estuary as an example. AGU-ASLO Ocean Sciences, San Antonio, USA, 25-28 January.

Grutters, M., E. Epping, D. Glavin, J. Bada, J.W. de Leeuw, W. Helder & W. Van Raaphorst. Amino acids in N.E. Atlantic continental slope sediments: indicators of *de novo* bacterial synthesis of amino acids. Postgraduate Institute in Fossil Fuels and Environmental Geochemistry (NRG), University Newcastle upon Tyne, Newcastle, UK, 14 December.

Hannon, E., C. Lancelot, C. Veth, & H.J.W. De Baar. Multi-factor control of the plankton dynamics and carbon cycling in the modern Southern Ocean: a modeling approach. AGU-ASLO Ocean Sciences, San Antonio, USA, 25-28 January.

Helder, W. & E. Epping. Organic C mineralisation in Iberian Margin Sediments: The role of canyons. OMEX II Symposium, Liege, Belgium, 8-13 May.

Helder, W. Recycling of organic matter in sediments along European continental margins. IGBP-symposium, Aveiro University, Aveiro, Portugal, 30 October.

Herndl, G.J. & J.M. Arrieta. Interspecific differences in the sensitivity of bacterioplankton to ultraviolet radiation: cell death or temporary inhibition? AGU-ASLO MeOcean Sciences, San Antonio, USA, 25-28 January.

Herndl, G.J. Heterotrophic bacterioplankton: phylogenetic diversity *versus* functional uniformity? Microbial loops: integrating microbes into the Mediterranean marine environment. CIESM workshop, Zichron Yaakov, Israel, 5-8 May.

Herndl, G.J. Quo vadis, Microbial Ecology. Institute of Ecology, University of Vienna, Austria, 26 May.

Herndl, G.J. Ultraviolet radiation and the microbial food web. LUW, Wageningen, 13 December.

Herndl, G.J., K.E. Stoderegger & C. Pausz. Significance of bacterioplankton-derived DOM for the oceanic DOM pool and its transformation. EGS 25TH General Assembly, Nice, France, 24-29 April.

Herndl, G.J., K.E. Stoderegger, C. Pausz & M.T. Perez. Bacterioplankton extracellular release: a novel source of colloidal organic carbon in the sea. ASLO Aquatic Sciences, Copenhagen, Denmark, 5-9 June.

Huthnance, J.M., H.M. Van Aken & M. White. OMEX – Water flux estimates. 32nd International Liège Colloquium on Ocean Hydrodynamics, Exchange processes at the ocean margins. 8-12 May.

Jansen, J.H.F. & G.J.M. Versteegh. Interactions between South Atlantic Ocean and African climate. NEBROC Workshop, University Bremen, Bremen, Germany, 25 January.

Jansen, J.H.F. & S. Mulitza. Climate history: Results NEBROC in the past 2 years and prospects. NEBROC Workshop, University Bremen, Bremen, Germany, 25 January.

Jansen, J.H.F. CORTEX, a shipboard XRF-scanner for element analyses in split sediment cores. Meeting Scientific Measurement Panel ODP, NIOZ, 16 June.

Jansen, J.H.F. Land climate signals in marine sediments, University of Cape Town, South Africa, 20 March.

Jansen, J.H.F. Late Quaternary frontal movements in the SE Atlantic region, University of Cape Town, South Africa, 20 March.

Johansson, M., F. Linares, T.K. Sands, P.L. Croot. Seasonal Changes in Trace Metal Speciation in the Skagerrak and Gullmars fjord, Sweden, AGU-ASLO Ocean Sciences, San Antonio, USA, 25-28 January.

Kinkel, H. A biomarker approach to coccolithophore research. Symposium at the Royal Dutch Society of Botany, Leiden, 6 April.

Kinkel, H., K.-H. Baumann, M. Geisen, I. Probert, H. Stoll, J.R. Young & P. Ziveri. Size matters. The influence of coccolith size and growth variation on reconstructing past carbon cycles. INA 8, Bremen, Germany, 11-15 September.

Kinkel, H., R. Pancost, C. Pelejero, J. Grimalt, M. Kienast & M. Sarnthein. Using alkenone $\delta^{13}C$ to reconstruct glacial/interglacial pCO_2 changes: a case study from the South China Sea. EGS 25th General Assembly, Nice, France, 25-29 April.

Klein Breteler, W.C.M. Role of essential nutrients in the quality of food for zooplankton. ASLO Aquatic Sciences, Copenhagen, Denmark, 5-9 June.

Koski, M., W. Klein Breteler, N. Schogt & S. Gonzalez. Nutritional needs of copepods: grazing, production and survival of *Pseudocalanus elongatus* and *Temora longicornis* in mixtures of algae. ASLO Aquatic Sciences, Copenhagen, Denmark, 5-9 June.

Lavaleye, M.S.S. Research on tidal flats in tropical NW-Australia. Nederlandse Malacologische Vereniging, Rotterdam, 19 November.

Leclerq, M., H.J.W. De Baar, J. Van der Plicht, H.A.J. Meijer & D. Hansell. Modest role of DOC in global oceanic carbon cycle. AGU-ASLO Ocean Sciences, San Antonio, USA, 25-28 January.

Loncaric, N. Mid Pleistocene history of the Benguela Current, SE Atlantic (ODP site 1085). 2nd Croatian geological congress, Cavtat, Croatia, 17-20 May.

Luttikhuizen, P.C. Optimal size of eggs that face the prospect of sperm limitation. 6th Meeting of PhD students in Evolutionary Biology, Vaalbeek, Belgium, 15-19 March.

Luttikhuizen, P.C., J. Drent & W. Van Delden. How quantitative genetic methods reveal, and molecular markers do not, small-scale population structure in a marine bivalve with putatively high gene flow. Evolution 2000, Bloomington, Indiana, USA, 23-27 June.

Maas, L.R.M. & G. Van Der Schrier. A simplified description of ocean circulation by means of the dynamics of its lowest moments. Workshop on Dynamical system concepts in climate dynamics, KNMI, de Bilt, 20 April.

Maas, L.R.M. Geometric focusing of inertial waves and its geophysical implications. Grenoble - User meeting Coriolis large turntable facility, Grenoble, France, 2 March.

Maas, L.R.M. Geometric focusing of waves in stratified and / or rotating fluids. TUE - Theor. Phys., Eindhoven, 6 September, and UT, Enschede - Appl. Math., Enschede, 5 October.

Maas, L.R.M. On the possible role of internal and inertial waves in climate. Clivar -workshop ALW, Amsterdam, 16 March.

Maas, L.R.M. The amphidromic structure of inertial waves in a rectangular container. Euro Mech conference, Eindhoven, 19 November.

Maas, L.R.M. Wave attractors in stratified and rotating fluids. Meteorological Insitute Stockholm University, Stockholm, Sweden, 25 January.

Manders, A.M.M., M.H. Rienstra & L.R.M. Maas. Inertial waves in a rectangular basin with a sloping boundary. EGS, 25th General Assembly, Nice, France, 25-29 April, and Buys-Ballot Symposium, Kerkrade, 26-27 October.

Marchant, R., H. Behling, A. Boom, et al.. Pollen based biome reconstructions for Latin America: applications at a range of spatial and temporal scales and links to climate and vegetation model output. Abstract PAGES Symposium, KNAW, Amsterdam, 3 November.

Marret, F., F. Scourse, G.J.M. Versteegh, J.H.F. Jansen & R.R. Schneider. Interlatitudinal phasing of abrupt climate changes during the last deglaciation: the equatorial record. Quaternary Research Association, Millennial Scale Changes, Southampton, UK, 6-7 January.

Mommersteeg, H., R. Van 't Veer, G. Islebe, H. Hooghiemstra, A. Boom & T. Van Der Hammen. Millenium-scale climate variability (Dansgaard-Oescher cycles), and aspects of immigration and floral evolution from 170-kyr and 600-kyr Colombian pollen records at 4 N. PAGES Symposium, KNAW, Amsterdam, 3 November.

Muyzer, G. Application of PCR-DGGE in environmental microbiology. Thermal Biology Institute, Bozeman, USA, 16 October.

Muyzer, G. Characterization of complex bacterial communities by denaturing gradient gel electrophoresis and single strand conformation polymorphism, RIVM, Bilthoven, 17 March.

Muyzer, G. Community fingerprinting in aquatic ecosystems. ASLO Aquatic Sciences, Copenhagen, Denmark, 5-9 June.

Muyzer, G. Microbial diversity research - Current status and future perspectives, Alicante, Spain, 25-27 September.

Muyzer, G. Status and perspectives of structure and function analysis of microbial communities in the marine environment. Themadag NECOV/NVvM over het "Belang van micro-organismen voor het functioneren van ecosystemen". Wageningen, 9 November.

Muyzer, G. The use of molecular methods to study complex microbial communities. Kluyver Institute for Biotechnology, Delft, 27 October.

Muyzer, G. Use of DGGE in analysing microbial community structure. European Union-workshop on "Microbial diversity in Aquatic Systems". Roscoff, France, 25-27 June.

Obernosterer, I & G.J. Herndl. Differences in the optical and biollogical reactivity of the humic and non-humic component of marine and terrrestrially-derived DOC in contrasting coastal systems. AGU-ASLO Ocean Sciences, San Antonio, USA, 24-28 January.

Obernosterer, I., R. Sempéré & G.J. Herndl. Ultraviolet radiation induces a reversal of the bioavailability of DOM to marine bacterioplankton. 25th General Assembly EGS, Nice, France, 24-29 April.

Pancost, R. D., J.S. Sinninghe Damsté & the MEDINAUT Shipboard Scientific Party. Heterogeneity of methane oxidizing archaeal and bacterial consortia in Mediterranean mud volcano sediments. 5e Nederlands Aardwetenschappelijk Congres, Veldhoven, 20-21 April.

Pancost, R., E.C. Hopmans, J. Werne & J.S. Sinninghe Damste. Heterogeneity of anaerobic methane-oxidizing archaeal communities in the Mediterranean inferred from lipid distributions and carbon isotopic compositions. Goldschmidt 2000, Oxford, UK, 3-8 September.

Pancost, R.D., E.C. Hopmans & J.S. Sinninghe Damsté. Microbial processes in mud volcano sediments elucidated by molecular and isotopic proxies. 2nd Medinaut Post-Cruise Meeting, Brest, France, 8-9 June.

Peeters, F.J.C. Planktic foraminifera in the Arabian Sea: seasonal distribution and stable isotope composition. Dept. Biological Oceanography, Directorate Marine & Coastal Management, Cape Town, South Africa, 11 August.

Pérez, M.T., C. Pausz, G. Kramer & G.J. Herndl. The contribution of bacterial derived compounds to the DOC pool in the North Atlantic: production rates and turnover. 7th European Marine Microbiology Symposium, Noordwijkerhout, 18-22 September.

Philippart C.J.M. Decadal and centennial variations and long-term changes within the North Sea and Wadden Sea ecosystems. NEBROC Workshop, Bremen, Germany, 25-27 January.

Philippart C.J.M. Long-term time series at NIOZ: Wadden Sea and North Sea. IWANOR meeting, NIOZ, 19 January.

Philippart C.J.M., J.J. Beukema, O.G. Bos & J. Van Der Meer. Recruitment and settlement processes in marine bivalve stocks. 10th International Scientific Wadden Sea Symposium, Groningen, 1 November.

Piersma, T. & Å. Lindström. Introducing the workshop on 'Physiological limitations in ecology'. OIKOS-meeting, Lund University, Sweden, 9 February.

Piersma, T. & H. Boyd. Integrated shorebird monitoring over the next 30 years: the need for clear-headed counting, ringing, and analyses. Invited Talk at Wader Study Group 2000 Conference, Norwich, 9 September 2000.

Piersma, T. & N.C. Davidson. Eco-physiologiacl research to define requirements for long-distance migrants Symposium 'Protected bird areas in Europe: selection, management and protection', British Ornithologists' Union, University of Leicester, UK, 15 April.

Piersma, T. A demographic study of Red Knots. 5th Western Sandpiper Workshop, Simon Fraser University, Vancouver, Canada, 21 October.

Piersma, T. A progress report on the cost-benefit analyses of habitat choice in Red Knots, using energy as a common currency. Special Zoology Seminar, University of Washington, Seattle, USA, 16 October.

Piersma, T. Why should we stop mechanical cockle-fishery in the Wadden Sea? Netherlands Organisation for Scientific Research (NWO), Nieuwspoort, 27 September.

Piersma, T. Consequences of mechanical shellfisheries for birds in the Wadden Sea. Presentation for Fryske Foriening foar Fjildbiology & SOVON-Friesland, Akkrum, 9 November.

Piersma, T. Daily energy expenditure of arctic breeding shorebirds: where and why do they hit metabolic ceilings? 5th Western Sandpiper Workshop, Simon Fraser University, Vancouver, Canada, 20 October.

Piersma, T. Fragility and protection of the worldwide populations of migrant shorebirds. Dynamics of biodiversity, Biological Centre, RUG, Groningen, 21 June.

Piersma, T. General points about starvation: prey quality and the incremental effects of stress. Workshop on mass-mortality in Eider ducks in winter 1999/2000, NIOZ, 20 April.

Piersma, T. Knots in space: diet and habitat selection in a molluscivore shorebird. Behavioural Ecology Seminar, Department of Biological Sciences, Simon Fraser University, Vancouver, Canada, 19 October.

Piersma, T. Knots: inescapable world-travellers. 14th Conference for Biological Education, Lunteren, 14 January.

Piersma, T. The distribution of Red Knots over Wadden Sea mudflats, and the threat of mechanical shellfisheries. Fall Semester Marine Biology Lecture, Bamfield Marine Station, Vancouver Island, Canada, 26 October.

Piersma, T. The fragility of migrant shorebirds. Symposium Koninklijk Nederlands Geologisch Mijnbouwkundig Genootschap on 'The Wadden Sea, the earth sciences and society'. Naturalis, Leiden, 22 June.

Piersma,T., J. Van Gils, B. Spaans & A. Dekinga. Why knots need space: food and habitat requirements of a mollusc-eating long-distance migrant. 10th International Scientific Wadden Sea Symposium, Groningen, 1 November.

Probert, I., M. Geisen, H. Kinkel & J. R. Young. Culture studies of *Algirosphaera robusta*. INA 8, Bremen, Germany11-15 September.

Reneerkens, J. The knot: unbelievable adaptations to an extreme way of life. Natuurhistorisch Genootschap in Limburg, 11 November.

Reneerkens, J. What plumage can tell about the vitality of a wader population. Vogelwerkgroep Castricum, Castricum 14 November.

Richter, T.O., Tj.C.E. Van Weering, H. De Haas, S.J. Van Der Gaast, B. Koster, A. Vaars. North Atlantic Paleoceanography: (Preliminary) Results on ENAM and IMAGES sediment cores. NEBROC Workshop, University Bremen, Bremen, Germany, 25 January.

Ridderinkhof, H. Agulhas Current Sources Experiment (ACSEX-I). KNMI, de Bilt, 12 December.
Ridderinkhof, H. Agulhas Current Sources Experiment (ACSEX-I). UU, Utrecht, 2 May.
Ridderinkhof, H. First results of ACSEX – leg 7 – Pelagia around Africa, Scheveningen, 8 June.
Ridderinkhof, H. Hydrodynamics and morphodynamics of tidal inlets: field observations. NCK congress, Zandvoort, 27-28 Februari.
Ridderinkhof, H. Temporal variability in salinity, temperature and currents in a tidal inlet: results from long-term ferry observations. Int. Biennial Conf. On Physics of Estuaries and Coastal Seas. Norfork, USA, 7-11 October.
Riegman, R. Long-term phytoplankton-nutrients interactions in the Western Wadden Sea. RIKZ workshop, The Hague, 24 May.
Ruardij, P. Benthic-Pelagic Coupling. Bio-ecological observations in operational oceanography. EUROGOOS / ICES workshop, The Hague, 6-8 April.
Schäfer, H. & G. Muyzer. Changes in diversity of marine microbial communities studied in nutrient enriched mesocosms. ASLO Aquatic Sciences, Copenhagen, Denmark, 5-9 June.
Schefuß, E., G. Lavik, J.-B. Stuut, R.D. Pancost, J.H.F. Jansen & J.S. Sinninghe Damsté. Dust-transported carbon and climate signals to the deep sea. 5^{e} Nederlands Aardwetenschappelijk Congres, Veldhoven, 20-21 April.
Schefuß, E., G. Lavik, J.-B. Stuut, R.D. Pancost, J.H.F. Jansen & J.S. Sinninghe Damsté. Terrestrial n-alkanes in dust and sediment. University of Oldenburg, Oldenburg, Germany, 25-26 May.
Schefuß, E., J.S. Sinninghe Damsté & J.H.F. Jansen. The mid-Pleistocene climate transition: Insight from organic geochemical records from the tropical Atlantic. NEBROC Workshop, University of Bremen, Germany, 27 November-1 December.
Schefuß, E., R.D. Pancost, J.H.F. Jansen & J.S. Sinninghe Damsté. The mid-Pleistocene climate transition: Insight from organic geochemical records from the tropical Atlantic. Goldschmidt 2000, Oxford, UK, 3-8 September.
Schmidt, S., T.C.E. Van Weering, H.C. De Stigter, J.-L. Reyss & P. Van Beek Recent deposition and reworking at the sea-water interface over the Iberian Margin: seasonal and spatial trends. Final OMEX II Workshop, Liège, Belgium, 8-12 May and 3^{o} Simpósio sobre a Margem Continental Ibérica Atlântica, Faro, 25-27 September
Schouten, S. Tracing molecular fossils using IRM-GCMS. Benelux Isotope Users Meeting, Maastricht, 24 February.
Schouten, S., S. Özdirekcan, B.E. Van Dongen, M.T.J. Van Der Meer & J.S. Sinninghe Damsté. Compound-specific stable carbon isotopes: The effect of biosynthetic pathways. Goldschmidt 2000, Oxford, UK, 3-8 September.
Simons, D-J. H., Kenig, F.& J.S. Sinninghe Damsté. Evidence of C4 plants at 35 N during the Cenomanian-Turonian OAE: a 40-80 % drop in atmospheric CO_2? 2000 Fall Meeting of the American Geophysical Union (AGU), San Francisco, USA, 15-19 December.
Sinninghe Damsté, J.S. Compound-specific isotope analysis of non-carbon elements: session introduction. Gordon Research Conference on Organic Geochemistry, Holderness, USA, 13-18 August.
Sinninghe Damsté, J.S. Mid-Cretaceous black shales in the proto North Atlantic Ocean: New insights from molecular palaeontology. Woods Hole Oceanographic Institution, Woods Hole, USA, 11 August.
Sinninghe Damsté, J.S., M.M.M. Kuypers & R.D. Pancost. The Cenomanian/Turonian crisis: biomarker evidence for an euxinic ocean and a 50% drop in pCO_2. Geoscience 2000 meeting, Manchester, UK, 17-20 April.
Slezak, D., A. Brugger & G.J. Herndl. Effects of solar radiation on the production and consumption of DMSP and DMS in the upper water column. 7th European Marine Microbiology Symposium, Noordwijkerhout, 18-22 September.
Smittenberg R.H., R.D.Pancost, J.S.Sinninge Damsté & M. Paetzel. Laminated sediments from silled, anoxic fjords: What can they tell us ? University of Oldenburg, Oldenburg, Germany, 25-26 May.
Stoll, H., Y. Rosenthal, P. Falkowski, C. Klaas, P. Ziveri, K.-H. Baumann, B. Boeckel, H. Kinkel & G. Ganssen. Sr/Ca of coccolith carbonate: testing the stories of the smallest carbonate repositories. EGS 25th General Assembly, Nice, France, 25-29 April.
Stuut, J.-B.W., M.A. Prins, R.R. Schneider, G.-J. Weltje, J.H.F. Jansen & G. Postma. Late Quaternary climate variability in SW Africa: grain size of terrigenous sediments from Walvis Ridge as a proxy for wind strength and aridity. Images-ODP Workshop, Carcans, France, 19-21 April, EGS 25th General Assembly, Nice, France, 25-29 April, and NSG Annual Symposium, Utrecht, 14 December.
Ten Hallers-Tjabbes, C.C. & A. Bos. Interactive case study in scientific activities in a societal process. Lecture course Department of Chemistry, RUG, Groningen,8 May.
Ten Hallers-Tjabbes, C.C. & C.M. Ree. Interactive case study in communication between scientists and policy makers for environmental issues. Lecture course Department of Chemistry, RUG, Groningen, 10 March.
Ten Hallers-Tjabbes, C.C. Antifouling, TBT and the marine environment. Lecture course Department of Chemistry, RUG, Groningen, 24 February.
Ten Hallers-Tjabbes, C.C. Aspects of microcontaminants, ecotoxicology and case studies, Lecture series "Water Systems", Faculty of Biology, RUG, Groningen, 8 May.
Ten Hallers-Tjabbes, C.C. Environmental effects of TBT antifouling from commercial shipping and associated sources, such as harbour dredge material. Seminario TBT Antifouling, Rio de Janeiro, Brazil, 28 August.

Ten Hallers-Tjabbes, C.C. Environmental effects of TBT antifouling from commercial shipping and associated sources, such as harbour dredge material. Seminario Brazilian Government., Brasilia, Brazil, 30 August.

Ten Hallers-Tjabbes, C.C. Environmental impact of TBT as recognised from scientific findings. Seminar 'Control of TBT-based Anti-fouling Paints for Environmental Protection', World Maritime University, Malmö, Sweden, 12 September.

Ten Hallers-Tjabbes, C.C. Environmental impact of TBT in the Waddensea as recognised from scientific findings. Conference 'TBT: A threat to the oceans shown in three ecoregions – environmentally sound ship paints as alternatives.' WWF-Initiative Global 2000, Hannover, Germany, 19 September.

Ten Hallers-Tjabbes, C.C. HIC-TBT project and impact of TBT in open sea, Simposium: "Impacto de las pinturas antivegetativas marinas con base TBT sobre las áreas costeras" (*Impact of TB-based antifouling paints on coastal areas)*. University of Huelva, Spain, 2 June.

Ten Hallers-Tjabbes, C.C. Presentation MEPC 44/INF.11, London Convention 1972 SCIENTIFIC GROUP - 23rd Meeting, (LC/SG 23), Townsville, Australia, 15-19 May.

Ten Hallers-Tjabbes, C.C. Sensory perception, behaviour and the environment. NIOZ, 6 April.

Ten Hallers-Tjabbes, C.C. TBT and the Marine Environment. Lecture Series Van Hall Institute, Leeuwarden, 1 February

Ten Hallers-Tjabbes, C.C. Threats and constraints posed to fish by nature. Conference 'The Environment and the Common Fisheries Policy – Threats to and constraints on sustainability.' Greenwhich Forum, Royal Society, London, UK, 27 January.

Thomas, H., V. Ittekkot & M.H. England. Deeper penetration and a higher anthropogenic CO_2 inventory in the ocean. AGU-ASLO Ocean Sciences, San Antonio, USA, 23-28 January.

Timmermans, K.R. Growth velocities of large and small diatoms in the Southern Ocean in relation to the bioavailability of iron. NVKD (Nederlands-Vlaamse Kring van Diatomisten), Utrecht, 14 April.

Timmermans, K.R. Co-limitation of marine diatoms by light and iron. NEBROC Annual meeting, Bremen, Germany, 25–27 January.

Timmermans, K.R. The role of iron and light on marine ecosystem structure. KNBV (Koninklijke Nederlandse Botanische Vereniging), sectie Algologie, Leiden, 6 April.

Timmermans, K.R. The use of laboratory containers. INMAR TECH, NIOZ, 22 September.

Van Bennekom, A.J. How important is the Southern Ocean for the oceanic silica cycle? Workshop AWI, Bremerhaven, Germany, 19 October.

Van Bennekom, A.J., S.J. de Groot & L. Otto. Dutch involvement in fisheries research, prior to and in early ICES. Hundred years of science under ICES, Helsinki, Finland, 1-4 August.

Van Den Bergh, G.D. Evolution of the Elephantoidea in the Indonesian Region. Symposium Biogeography of Southeast Asia 2000 - organisms and orogenesis -, Noordwijk, 4-9 June.

Van Den Bergh, G.D. Recent sediments and sediment accumulation rates in Teluk Banten (West Java). Workshop on the Teluk Banten Research Programme, Amsterdam, 27 November 2000

Van Den Bergh, G.D.& T.J.E. Van Weering. Sedimentological studies and deposition rates in the Balat delta system, Vietnam. Workshop on the Red River Delta Research Programme, Hanoi, Vietnam, 14-15 July, 2000.

Van Der Meer, J. Population dynamics of *Macoma balthica*. Nederlandse Malacologische Vereniging, Amsterdam, 15 April.

Van Der Schrier, G. & G.J.M. Versteegh. Distinguishing external and internal climate forcing. Workshop on Dynamical Systems Concepts in Climate Dynamics, KNMI, De Bilt, 18 April.

Van Der Schrier, G. & G.J.M. Versteegh. Internally and externally forced climate variability: A dynamical systems approach using the Central England Temperature record. Institute of Hydrophysics, GKSS Research Centre, Geesthacht, Germany, 27 September.

Van Der Veer, H.W. Fish sorting container: an evaluation. Inmartech, NIOZ, 22 September.

Van Der Zee, C., W. Van Raaphorst & E. Epping. Adsorbed manganese and Mn redox cycling in Iberian continental margin sediments. 5e Nederlands Aardwetenschappelijk Congres, Veldhoven, 20-21 April.

Van Der Zee, C., W. Van Raaphorst & E. Epping. Diagenetic importance of adsorbed Mn, NIOZ, 24 February.

Van Dongen, B.E., Structural and stable carbon isotopic analysis of carbohydrates in sediments and organisms. University of Oldenburg, Oldenburg, Germany, 25-26 May.

Van Duyl, F.C. Consequences of diatom mat erosion for carbohydrate content and heterotrophic bacterial activity in intertidal sediments. 7th European Marine Microbiology Symposium (EMMS). Noordwijkerhout, 17-22 September 2000

Van Haren, H. & J.R. Gemmrich. Internal wave band kinetic energy production in the Southern North Sea. PROVESS Semi-annual Meeting, Brussels, Belgium, 21-22 September.

Van Raaphorst, W. The influence of internal waves on the erosion and deposition across the slope of the Faeroe-Shetland Channel. Institute for Earth Sciences, RU, Utrecht, 19 April.

Van Raaphorst, W., H. Malschaert & H. Van Haren. Cross-slope zonation of erosion and deposition in the Faeroe-Shetland Channel. EGS 25th General Assembly, Nice, France, 25-29 April.

Van Weering, T.C.E. & G.Van Den Bergh Recent sediments and sedimentation in a small embayment, Teluk Banten, West Java. Univ. of Seattle, Washington, USA, 12 December.

Van Weering, T.C.E., H.Lykke Andersen, H.De Haas, A.Akhmetzanov, N.Kenyon & M.Ivanov. Giant cold water Coral Carbonate mounds at the SE and SW Rockall trough Margins, NE Atlantic Ocean. AGU Conference, San Francisco, USA, 15-19 December.

Van Weering, T.J.E. & H. De Stighter. Recent sediment accumulation and carbon burial along the NW European margin: Results of the OMEX I and II programs. Ocean Sciences Meeting, AGU, San Antonio, 24-28 January 2000.

Van Weering, T.J.E. Deep Sea Studies; Progress and Challenges. Deep Sea Workshop Salzau,Geomar, Kiel, Germany 28-31 March.

Van Weering, T.J.E., J.-M. Jouanneau, H.C. De Stigter, L. Thomsen & O. Weber. Recent Sediment Transport, Accumulation and Organic Carbon Burial Fluxes at the NW European Margin; Results of the OMEX I and II Programs. 32nd Int.Liège Coll. On hydrodynamics, Liége, Belgium, 8-12 May and Univ. Seattle, Washington, USA, 11 December.

Veldhuis, M. Tracing DNA in marine plankton. UvA, 20 April.

Veldhuis, M.J.W., G. Muyzer & G.W. Kraay. Biodiversity in Oceanic ecosystems: (phyto- and bacterioplankton). MARE-1 workshop, IMAU, Utrecht, 15 May.

Versteegh, G.J.M, F. Marret, R.D. Pancost, R.R. Schneider, E. Ufkes, J.H.F. Jansen & J.W. De Leeuw. Tropical lowland vegetation change and its relation to atmospheric CO_2 and aridity for the last deglaciation. EGS 25th General Assembly, Nice, France, 25-29 April.

Versteegh, G.J.M. Aspects of dinoflagellate chemistry: biomarkers, toxins and cyst-wall composition. Symposium at the Royal Dutch Society of Botany, Leiden, 6 April.

Versteegh, G.J.M., J.W. De Leeuw, G. Cini-Castagnoli, G. Bonino & A. Romero. Solar driven environmental change in the Mediterranean from 1635 to 1975. CLIVAR-Meeting, Amsterdam, 16-17 March.

Veth, C. MARE-project, first data. KNMI, de Bilt, 12 December.

Veth, C. The MARE-project. University of Cape Town, Cape Town, South Africa, 26 February.

Vosjan, J.H. Introduction to marine microbilgy and capita selecta. Univ. Libre, Brussel, Belgium, 21-24 March.

Weber, A., S. Van Steenpaal, R. Witbaard. Turbulence in a bivalve's life or can depth camouflage age? North Sea 2000, Burning issues of North Sea ecology. 14th international Senckenberg Conference. Wilhelmshaven, Germany, 8-12 May.

Weber, A. *Astarte sulcata* distribution and growth in the Faroe-Shetland Channel. Kristineberg Marine Research Station, Kristineberg, Sweden, 15 October.

Weinbauer, M.G. Viral ecology of the Mediterranean Sea. Station Zoologique Villefranche sur Mer, France, 3 October.

Weinbauer, M.G. Viral strategies and their role in water column processes. 7th European Marine Microbiology Symposium, NoordwiJkerhout, 17-22 September.

Wernand, M.R. Bio-optical modelling of the remote sensing reflectance. Colors technical/scientific final meeting, JRC, Ispra, Italy, 4-6 December.

Wernand, M.R. Validation of remote sensing reflectance derived total suspended matter. Colors technical/scientific final meeting, JRC, Ispra, Italy, 4-6 December.

Werne, J.P. & D.J. Hollander. Anomalous carbon isotope biogeochemistry in the Cariaco upwelling system: Balancing the effects of biological and oceanographic processes. Goldschmidt 2000, Oxford, UK, 3-8 September.

Werne, J.P., D.J. Hollander, T.W. Lyons, E.C. Hopmans, M. Baas, M. Ricci, S. Schouten & J.S. Sinninghe Damsté. Bulk and molecular sulfur isotope constraints on the timing and pathways of diagenetic sulfurization of organic matter. Gordon Research Conference on Organic Geochemistry, Holderness, USA, 13-18 August.

Winter, C., M.M. Moeseneder & G.J. Herndl. Impact of ultraviolet radiation on bacterioplankton community composition in marine surface waters. ASLO Aquatic Sciences, Copenhagen, Denmark, 5-9 June.

Witbaard, R. Tree of the sea. Climate reconstructions based on the bivalve *Arctica islandica*. CLIVAR days, Climate variability in The Netherlands: Chances and Challenges. KNAW, Amsterdam, 16 March.

Witbaard, R., G.C.A. Duineveld, M. Bergman. Growth of benthic interface feeders in a frontal zone. North Sea 2000, Burning issues of North Sea ecology. 14th international Senckenberg Conference. Wilhelmshaven, Germany, 8-12 May.

EXTERNAL PROFESSIONAL FUNCTIONS

M.A. Baars

- member JGOFS Indian Ocean Synthesis and Modelling Group (SCOR)
- member Working Group JGOFS Nederland
- member Working Group GLOBEC Nederland

R.P.M. Bak

- professor Tropical Marine Biology, University of Amsterdam
- senior Editorial Advisor Marine Ecology Progress Series
- member Netherlands SCOR Committee (KNAW)
- member Board Foundation for Scientific Research Surinam and the Netherlands Antilles
- member council International Society for Corel Reef Studies

M.J.N. Bergman
- member ICES Working Group on Ecosystem Effects of Fishing Activities
- member ICES Study Group on the Work programme to Evaluate the Environmental Impacts of Fisheries
- member Raad van Overleg voor het Fysisch-oceanografisch onderzoek Noordzee - Overleggroep Bodem
- member ICES Benthos Ecology working group

J.J. Beukema
- editor Journal of Sea Research

J.P. Boon
- member ICES Marine Chemistry Working Group
- member ICES Working Group on Biological Effects of Contaminants

T.F. de Bruin
- secretary National Oceanographic Data Committee (NODC)
- member Joint Committee on Antarctic Data Management (JCADM)

G.J.A. Brummer
- member NWO/ALW 'gebruikers-adviesgroep verankerde systemen'
- alternate member of the board of NEBROC
- chairman of the steering committee Around Africa

G.C. Cadée
- editor Journal Sea Research
- associate editor ICHNOS
- board member 'Nederlands Vlaamse Kring van Diatomisten'
- associate editor Senckenbergiana Maritima
- Commissie voor de geschiedenis van de aardwetenschappen, KNAW

C.J. Camphuysen
- board member Dutch Seabird Group (NZG), section Netherlands Ornithologists' Union (NOU)
- editor Atlantic Seabirds
- editor and secretary editorial team Ardea
- member editorial board Marine Ornithology
- co-ordinator Dutch beached bird survey (NZG/NSO)
- member ICES Working Group on Seabird ecology (WGSE)
- chairman European Seabirds At Sea Database co-ordinating group (ESASD)
- member Scientific Panel Sustainable Ecosystems Institute, Oregon
- consultant, CSR Consultancy

R. Daan
- member workinggroup 'Monitoring rond Mijnbouwinstallaties'

H.J.W. De Baar
- Professor of oceanography, University of Groningen
- Associate editor Marine Chemistry
- Coordinator, Carbondioxide Uptake in the Southern Ocean (CARUSO, EU)
- Coordinator, Iron Resources and Oceanic Nutrients - Advancement of Global Environment Simulations (IRONAGES, EU)
- Member, SCOR Working Group 109 Biogeochemistry of Iron in Seawater
- Member, Selection Committee Joint Infrastructure Fund (JIF) of UK NERC
- Member EU-USA Ocean Carbon Cycle Panel for IGBP Global Carbon Cycle initiative
- Life Member Clare Hall College, Cambridge
- Chairman, Panel 3 (Ocean and Atmosphere Sciences) of NWO/ALW open competition
- Chairman, Netherlands SCOR Committee of Royal Academy of Sciences (KNAW)
- Chairman, Netherlands Task Group on international SOLAS program of SCOR
- Member, Committee for the Netherlands Antarctic Program (NAAP/NWO)
- Member, Scientific Steering Committee Netherlands-Bremen Oceanography (NEBROC)
- Member, MAB/SCOPE/IGBP Committee of Royal Netherlands Academy of Sciences (KNAW)
- Member WaterManagement Group Hogeschool Alkmaar

J.W. De Leeuw
- board member Hanse Wissenschaftskollege
- board member EMaPS
- professor Organic Geochemistry University of Utrecht, Earth Sciences faculty
- member Koninklijke Nederlandse Akademie van Wetenschappen' (KNAW)
- board member LPP, University of Utrecht, Biology faculty
- board member Inst. für Chemie und Biologie des Meeres, Univ. Oldenburg, Germany
- board member working group Mol. Mech. and Anal. Chem. NIOZ-TUD
- professor Geochemistry, Univ. Barcelona, Spain

G.C.A. Duineveld
- member ICES Benthos Ecology working group

H.G. Fransz
- coordinator working group GLOBEC-NL

W. Helder
- chairman " Gebruikers Advies groep (GAG-ALW) Auto-analysers" (NWO)
- member Steering Committee UK-NERC programme Benthic Boundaries (BENBO)
- chairman ALW-apparatuur committee

G.J. Herndl
- Professor, biological oceanography, RUG
- member of the editorial board of aquatic Microbial Ecology
- member of the editorial board of Marine Ecology
- member of the scientific committee of NEBROC
- member scientific committee for planning the ASLO meeting held in Copenhagen, Denmark, 5-9 June
- Co-organizer 7th European Marine Microbiology Symposium in Noordwijkerhout, 17-22 September
- member scientific committee for planning the International Symposium for Microbial Ecology in Amsterdam in the year 2001
- Coordinator of the EU project COMET
- Reviewer for the Norwegian Science Foundation for Aquatic and Terrestrial Microbiology and Biotechnology
- Member of the Nominating Committee of the ASLO

J.H.F. Jansen
- member Scientific Committee IGBP-PAGES-IMAGES 2 (The Intern. Marine Past Global Change Study
- member Dutch Ocean Drilling Project (ODP) working group

W.C.M. Klein Breteler
- member users group Quantimet (Image Analysis)

G.W. Kraay
- member flow-cytometer working group

H.J. Lindeboom
- chairman Scientific Steering Committee LOICZ
- member Scientific Committee for the IGBP
- member Board of the Sir Allistair Hardy Foundation of Ocean Sciences
- member ICES working Group 'Effects of Fisheries'
- member 'Commissie voor Milieueffectrapportage'
- board member 'Onderzoekschool Functionele Ecology'
- member Steering Committee WOTRO project 'Rivers and coastal zones'
- member Steering Committee and working group Indonesian-Dutch Cooperative Research on Integrated Coastal Zone Management, Teluk Banten
- SYKON Advisory Committee, Hamburg, Germany
- member 'MER workinggroup 'Winning van beton- en metselzand op de Noordzee'
- member Scientific Committee 'North Sea 2000', 13th International Senckenberg conference
- member organizing committee IGBP-science conference, Amsterdam 2001
- member Editorial Board 'Archive of Fishery and Marine Research'
- member International Steering Committee International Advanced School 'Leonardo da Vinci', Bologna

L.R.M. Maas
- external examiner of thesis of Nicolas Perenne of LEGI (Grenoble), Universite Joseph Fourier, France.

M. Mulder
- member workinggroup 'Monitoring rond Mijnbouwinstallaties'

G. Muyzer
- member editotial board of Applied and Environmental Microbiology
- member editorial board of FEMS Microbiology Ecology
- member national scientific committee of 7th European Marine Microbiology Symposium, Noordwijkerhout, 17-22 September

R.F. Nolting
- member EC commission certification of sea- and estuarine water for trace metals

S. Ober
- member 'overleg-groep 'waarnemen en interpreteren', Raad van overleg fysisch-oceanografisch onderzoek Noordzee'

C.J.M. Philippart
- editor-in-chief Journal of Sea Research
- member NL-GLOBEC committee
- co-organizer 12th Verwey Symposium
- coordinator NWO project "Temporal scales of sustainable use of marine ecosystems"
- Guest editor Proceedings 4th International Symposium on Flatfish Ecology

T. Piersma
- associate Professor at the Centre for Ecological and Evolutionary Studies (CEES) at the University of Groningen
- vice-chairperson of the International Wader Study Group (IWSG)
- editor of Ardea
- member Editorial Board Current Ornithology
- member Editorial Board Zoology
- member of the Scientific Steering Committee of the International Ornithological Committee

H. Ridderinkhof
- member "programmacommissie NCK"
- member Committee `Milieueffectrapportage'
- member 'Beoordelingscommissie aanvragen ALW'
- member 'Beleidsadviescommissie Aardwetenschappen ALW'
- member of the EUROGOOS Science Advisory Working Group
- member EUROGOOS-NL

M.J. Rietveld
- member 'International research Ship Operators Meeting' (ISOM)

J.S. Sinninghe Damsté
- associate scientist University of Utrecht, faculty of Earth Sciences
- associate editor Organic Geochemistry

D.H. Spaargaren
- secretary 'Commissie voor buitenlandse marien-biologische instituten', KNAW, Amsterdam
- member Board of advisory editors Crustaceana
- secratary, treasurer organising committee 4th International Crustacea Congress
- chairman science committee subtheme Physiology & Biochemistry ICC4
- member Council of European Working Group on Chemical Evolution, Early Biolgical Evolution and Exobiology, Strassbourg (F)
- member Groupement for l'Avancement de la Biochemie Marine, Gif/Yvette (F)

M.H. Stoll
- member Joint Global Ocean Flux Study Data Management Task Team (JGOFS-DMTT)
- member Carbon dioxide in the North Atlantic Ocean (CARIAN) Steering Committee

C.C. Ten Hallers-Tjabbers
- Advisor to IUCN for the London Convention 1972
- External advisor Faculty of Zoology & Anthropology, University of Porto, Portugal
- Lady chairman Animal Navigation Group, Royal Institute of Navigation, London, UK

H.M. Van Aken
- member ICES Working Group on Ocean Hydrography

M.A. Van Arkel
- member Working group 'Monitoring rond Mijnbouwinstallaties'

S.J. Van Der Gaast
- member editorial board of Applied Clay Science
- president Dutch Clay Group
- member of the XRPD group of the NKV (Ned. Kristallografische Ver.)

J. Van Gils
- survey coordinator international Wader Study Group (IWSG)

J. Van Der Meer
- editor ARDEA
- member ICES Working Group on Statistical Aspects of Environmental Monitoring
- member of the Science Advisory Board of SOVON (Foundation for Ornithological Field Research in The Netherlands)
- member 'Onderwijscommissie Onderzoeksschool Functionele Ecologie'

H.W. Van Der Veer
- member organizing committee 4th International Symposium on Flatfish Ecology, Moorehead City, U.S.A.
- adjunct associate professor of Zoology, North Carolina State University, Raleigh, USA
- adjunct associate professor of Marine Science, University of South Carolina, Columbia, USA
- member Working Group on Recruitment Processes (ICES)
- guest editor Proceedings 4th International Symposium on Flatfish Ecology

F.C. Van Duyl
- board member Treub-Mij
- advisor Studiekring Suriname en de Nederlandse Antillen
- member European Scientific Diving Committee

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- member Dutch LOICZ commission
- editor Journal of Sea Research
- member SCOR working group 114 on permeable sediments
- member NWO/ALW "gebruikers advies groep geoapparatuur"
- member NWO/ALW programme-commission Dutch-Flemish cooperation
- member "Raad van toezicht" IPO-LOICZ

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- member Scientific Steering Committee EU-MAST Program ENAM
- member Editorial Board Geologie en Mijnbouw/Netherlands Journal Geo Sciences
- member Editorial Board Marine Geology
- member Editorial Board Boreas
- member Scientific Committee IMAGES
- special guest editor Progress in Oceanography Volume OMEX-II Benthic Processes

M.J.W. Veldhuis
- member working group JGOFS-NL
- member advisory board Sarsia (USA)
- member climate committee KNAW
- member flow cytometer working group NL

G.J.M. Versteegh
- Member GEM Working Group

C. Veth
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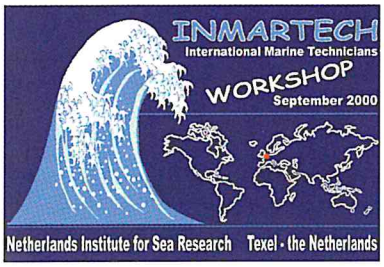
- member (Netherlands) Committee Antarctic Research
- member Working group Joint Ocean Global Flux Study NWO/GOA
- membr Editorial Board of Oceanologica Acta

M.R. Wernand
- member REmote sensing of WAter quality in the NETherlands group REWANET
- member Sensor Intercomparison and Merger for Biological and interdisciplinary Oceanic Studies [NASA] team. SIMBIOS

J.T.F. Zimmerman
- Professor Physical Oceanography, University of Utrecht
- member editorial board Continental Shelf Research
- IAPSO representative national UGGI comite (ARA-KNAW)
- member Committee 'Milieueffectrapportage'
- member New York Academy of Sciences

MEETINGS AND COURSES , HELD AT NIOZ

INMARTECH 2000



NIOZ organized and hosted the 3rd International Marine Technicians Workshop (INMARTECH) that was held from 20 - 22 September.

The purpose of INMARTECH is to provide a forum for international exchange of knowledge and experiences between marine technicians and to improve equipment performance during scientific cruises on research vessels. INMARTECH 2000 is sponsored by the European Commission and supported by the International research Ship Operators Meeting (ISOM) and the University-National Oceanographic Laboratory System (UNOLS).

INMARTECH is organised biannually. INMARTECH 2000 being the third workshop. The first workshop was held in 1996 in Southampton (UK) and the second in 1998 at the Scripps Institution of Oceanography in San Diego.

The set-up was aimed at facilitating easy interaction between technicians. Therefore technicians were invited directly, based on, country and technical back-ground. To facilitate discussions in small groups the total number of participants was limited, and ample time was inserted for informal get-together during coffee breaks on the spot, at lunch breaks and the joint evening meals. A participants booklet was made with short description of expertise, questions, interest to learn, and a photo gallery. Every participant received an information bag and a T-shirt with INMARTECH 2000 logo.

To facilitate the editing of the proceedings, every topic had one or two rapporteurs to summarize the sessions.

Approximately 110 participants from 15 countries participated in the workshop. Speakers were from Japan, the US, UK, Sweden, Germany, France and the Netherlands.

The workshop started with a 'wild' ice-breaker party the evening of the 19th, for which the NIOZ technical workshops were changed into a party hall.

The topics of INMARTECH 2000 were:

- Cable & Winch Technology (speakers from Southampton Oceanography Centre, Kley France and Van Lankhorst Touwfabrieken)
- Lander Technology (speakers from Woods Hole, MARUM, NIOZ, Göteborg University/Chalmers University of Technology and Technical University of Berlin)
- ADCP en CTD Technology (speakers van Scripps enand Southampton Oceanography Centre)
- Handling Heavy and Large Equipment (speakers from University of Washington, Southampton Oceanography Centre, British Antarctic Survey and JAMSTEC, and an evening speaker from the US Coast Guard)
- Coring and High Pressure Sampling (speakers from Ocean Drilling Program, British Geological Survey, and a video-display from the University of Berlin)
- Mooring Technology (speakers from Woods Hole, Southampton Oceanography Centre, TNO)
- Laboratory Container/Van Technology (speakers from CKT Projects, NIOZ and Woods Hole)

The Workshop was chaired by Dr. Ken Robertson, retired from SOC (UK), and co-chaired by Dr. Tjeerd van Weering (NIOZ).

For display at INMARTECH 2000 there was a continuous poster presentation, display of gear, hands on demonstrations, and a tour of the NIOZ marine facilities and research ship "PELAGIA".

From the first inventory of returned appraisal forms it can be concluded that INMARTECH 2000 was a success. The NIOZ hospitality was greatly appreciated, as was the informal set-up and choice of topics. As to the parallel sessions for some participants it was hard to make a choice.

For those who could stay a day longer the Workshop was concluded with an excursion on board R.V. Navicula to the Wadden Sea and the "Razende Bol" on 23 September.

(Photo's: E. Keijzer)

The overall wish was heard to create a specific INMARTECH web site with a pinboard and discussion room with links to different topics, for which the OCEANIC database has offered its assistance .
The proceedings are planned to be ready in draft early spring 2001, and will also be available electronically on the internet.
Next time (2002) INMARTECH will be organized by JAMSTEC in Japan.

The course Introduction to Oceanography is part of the Marine Biology curriculum at RUG and was attended by 30 students majoring marine biology. H.J.W. de Baar at RUG gave the introductory lectures from 7-18 February. The students followed a series of practical projects at NIOZ from 20-31 March, including field work at the tidal flats and aboard RV Navicula in the Wadden Sea and the North Sea. R.F. Nolting coordinated the practical part. The enthusiasm and commitment of a great number of NIOZ scientific and supporting staff once again ensured an overall very stimulating course.

The Marine Environmental Awareness Course is organized jointly by NIOZ and EcoMare. For NIOZ the programme was coordinated by M. Bik, J.P. Boon and M. van Arkel. This year the course was given twice; for the students of the Higher Maritime School 'Zeeland' (Vlissingen; 20 - 23 November), and the Maritime Institute 'Willem Barentsz' (Terschelling; 27 - 30 November). Besides students from these Maritime schools, several professionals also participated, e.g. officers from the companies Vopak Shipping BV and Wagenborg Shipping. General lectures were given by J.P. Boon, G. Herndl, A. Oosterbaan (Ecomare), H. van Aken, H. Thomass, R, Vermeulen (VOPAK Shipping BV), K. Booij, C.J. Camphuisen, C. ten Hallers-Tjabbes, J. Kemp (London University) & F.C. van Duyl.

The third annual NEBROC Basic Course in Marine Sciences took place at NIOZ from 2 – 13 October 2000, and was organized by E. Koning (NIOZ) and T. Bickert (Bremen). 13 students attended the course: from Bremen (3), NIOZ (2), NIOO-CEMO (2), Free University, Amsterdam (2) and IGM-Portugal (4).

Lectures were given by M. Rhein (Uni-Bremen), V. Smetacek (AWI), T. Bickert (Uni –Bremen), R. Schneider (Uni-Bremen) and by H. Ridderinkhof, T. Gerkema, C. Veth, L.R.M. Maas, J.J.M. van Haren, H.J.W. de Baar, M.H.C. Stoll, H. Thomas, S. Schouten, J.S. Sinnighe Damste, K. Booij, R. Dekker, W.M.C. Edelaar, P. Luttikhuizen, G.J. Herndl, G.-J.A. Brummer, J.H.F. Jansen, H. de Haas, M.J.N. Bergman, H.J. Lindeboom, F.J.C. Peeters, W. Helder and G.J.M. Versteegh from NIOZ. Besides lectures, demonstrations and excursions completed the course. Evenings were filled with student presentations and with an evening discussion on sustainable use of marine ecosystems.

Next years' basic course will be organized in Bremen.

3. Guest scientists, visitors and students

The NIOZ Guest house. Photo: B. Aggenbach

GUEST SCIENTISTS

- Augustin, C., University of Rostock, Germany, 27 October -3 December.
- Battley, P.F., Department of Ecology, Griffith University, Nathan, Brisbane, Australia, 21 November- 31 December).
- Berges, J., School of Biology and Biochemistry, Queen's University of Belfast, UK, 3-15 December.
- Cremers, Dr H.J.M., Parasitologist, Utrecht, 5-10 April.
- Gessaman, Prof. Dr J.A., Department of Zoology, State University of Utah, Logan, USA, 10 October - 28 December.
- Giacomucci, D. L., University of Bologna, Italy & CaTO Marine Ecosystems, 1 October – 31 December.
- Koski, M., Finnish Institute of Marine Research, Helsinki, Finland, 1 January-31 December.
- Landys, M., Department of Zoology, University of Washington, Seattle, USA, 1 April - 20 June.
- Marie, X., Laboratoire d'Ecologie du Plancton Marin, Universite Pierre & Marie Curie, Paris, France, 24 September – 17 October.
- Martinez, M., Departament de Genètica i de Microbiologia, Universitat Autònoma de Barcelona, Bellaterra, Spain, 2 - 28 October.
- Mendes, L., Department of Zoology, University of Lisboa, Portugal, 1 April - 20 June, 6-30 November.
- Oygarden, S., Norwegian College of Fishery Science, Univ. Tromsö, Norway, 25 September - 12 October.
- Reitner, B., Inst. of Ecology, Univ. of Vienna, Austria, 8-17 November.
- Schäfer, H., University of Bremen, Bremen, Germany, 2 January -30 December.
- Schmidt, K., University of Rostock, Rostock Germany, 7-10 November
- Shimoyama, Dr S., Department Earth & Planetary Sciences, Kyushu University, Fukuoka, Japan, 1 July – 14 September.
- Stadnitskaya, Drs.A. Moscow State University (MSU), Moscow, Russia, 15 September – 15 October, 2001
- Vichi, M., Yniv. Of Bologna, Italy, 1 January - 30 September.
- Wexel Riser, C., Norwegian College of Fishery Science, Univ. Tromsö, Norway, 12-23 October.

VISITORS

- Amann, R., Max Planck Institute for Marine Microbiology, Bremen, Germany.
- Benner, R., Department of Biological Sciences, University of South Carolina Columbia, USA.
- Bijma, J., Alfred Wegener Institut fuer Polar- und Meereskunde, Bremerhaven, Germany.
- Boyd, Dr H., Canadian Wildlife Service, Ottawa, Canada.
- Ferreira A., IPIMAR, Lisbon, Portugal.
- Green, M., Lund University, Lund, Sweden.
- Grice, K., Curtin University of Technology, Perth, Australia.
- Guglielmo, Dr C., University of British Columbia, Vancouver, Canada.
- Harvey, R., University of Maryland, USA.
- Heuermann, R., TriOS Optical Sensors, Oldenburg, Germany.
- Jürgens, K. Max Planck Institute for Limnology, Plön, Germany.
- Kaiser, E., EAWAG Zürich, Switzerland.
- Kim, J., University of Bremen, Germany.
- Kolar, I., Institute of Zoology, University of Vienna, Vienna, Austria.
- Kolonic, S., University of Bremen, Germany.
- Kroon, D., Grant Institute of Geology, University of Edinburgh, Edinburgh, UK.
- Kuroki, Dr K., Japan Marine Science and Technology Center (JAMSTEC), Yokosuka, Japan.
- Kvist, A., Lund University, Lund, Sweden.
- Lassen, Dr. S., Geological survey of Denmark and Greenland, Copenhagen, Denmark.
- Lutjeharms, Prof Dr J.R.E., Department of Oceanography, University of Cape Town, South Africa.
- Nakamura, Dr M., Reserch Support Department, Japan Marine Science and Technology Center (JAMSTEC), Yokosuka, Japan.
- Nilsson, J., Meteorological Institute Stockholm University, Stockholm, Sweden, 14-15 December.
- Oberhänsli, Dr H., GeoForschungsZentrum Potsdam (GFZ), Potsdam, Germany.
- Pazdro K., IFREMER, Nantes, France.
- Probert I., Lab. Biologie & Biotechnologies Marines, Université de Caen Basse Normandie, France.
- Rack, Dr F.R., Joint Oceanographic Institutions, Inc., Washington, DC, USA.
- Ruddock, P., Faculty of Applied Sciences, University of the West of England, Bristol, UK.
- Schneider, Dr R.R., Fachbereich GeowissenschaftenUniversity Bremen, Bremen, Germany.
- Simons D. J., University of Illinois, Chicago, USA.
- Slezak, D., Institute of Ecology, Univ. of Vienna, Austria.
- Small, R.J., DERA, Winfrith Technology Centre, UK.
- Sole, J., CSIC, Barcelona, Spain.
- Suttle, C., University of British Columbia, Vancouver, Canada.
- Suzuki, T., OREC Ltd, Tokyo, Japan.
- Tronczynski J., IFREMER, Nantes, France.

- Ward D.M., Montana State University, Montana, USA.
- Watkins, D., Wetlands International (Australasia - Oceania), Canberra, Australia.
- • Wolf, T., GKSS, Geesthacht, Germany.
- Ydenberg, Prof. R.C., Simon Fraser University, Vancouver, Canada.

UNDERGRADUATE UNIVERSITY STUDENTS.

- Boels, J., UU
- Brans, A.,van Hall Instituut, Leeuwarden
- Broersma, Th., UU
- Bruin, J., Hogeschool van Amsterdam, Amsterdam
- De Rooij, S., RUG
- Dijkstra, M., van Hall Instituut, Leeuwarden
- Dingerdis, T., Bakhuis Roozeboom Instituut, Beverwijk
- Escudero, G., RUG
- Foekema, W.
- Groeneveld, M. UvA
- Hoedemaker, J.R., Institute of Professional Education Larenstein.
- Kraan, C., RUG
- Luijendijk, A., TUD
- Luyt, P., RUG
- Moritz, S., Friedrich-Schiller Universität Jena, Germany
- Nortier, J., Department of Earth sciences, UU, Utrecht.
- Özdirekcan S., VU, Amsterdam.
- Petrov, E., MSU,Moscow, Russia
- Postma, C., Reynevelt College, Delft
- Postma, E.. LUW
- Rienstra, M., UU
- Swart, A., UU
- Sollie, H., UT
- Roosjen, M., LUW
- Sadekov, A., MSU, Moscow, Russia
- Schaapveld, M., UU
- Scheerder, N., Rijn IJsselcollege, Arnhem
- Sciborski, M., University of Gdansk, Polen
- Ter Keurs, B., Hogeschool Delft, Delft
- Termaat, S., Rijn IJsselcollege, Arnhem
- Terpstra, P.Q., UVA, Amsterdam, 1 februari-30 June.
- Van Den Bergh, Y., VU
- Van Der Geest, M., RUG
- Van Nieuwkerk, S., MLO, Rijn IJsselcollege, Arnhem
- Van Steenpaal, S., Internationale Agrarische Hogeschool Larenstein
- Van Veldhoven, A.K., UU
- Wilkens, A., van Hall Instituut, Leeuwarden
- Ypma, G., UU

4. Support Services

Photo: H. Ridderinkhof

THE TECHNICAL SUPPORT SERVICES

Contributors: *Herman Boekel, Theo Buisman, Marieke J. Rietveld, Jack Schilling*

Research Vessel PELAGIA

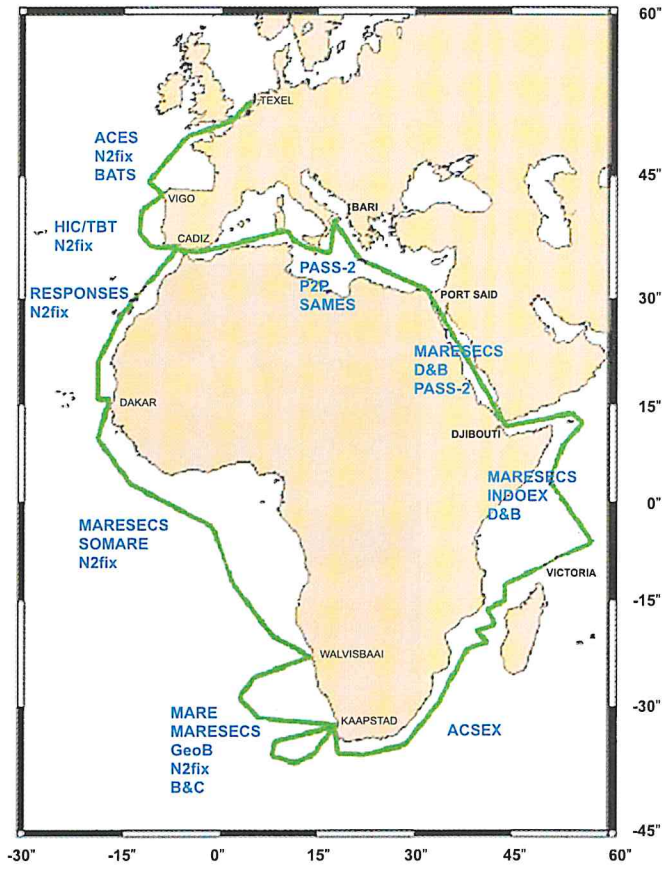
NIOZ owns and operates several marine research facilities, not only to accommodate its own scientific programme but also for the oceanographic community in the Netherlands. As a consequence of its position as a national institute and in relation to its mission NIOZ co-ordinates and takes care of the execution of sea-going research programmes funded by NWO in the framework of the national programme for sea-going research. A report on these MRF activities is given in chapter 1.

The largest sea-going facility is R.V. Pelagia, a 66 m multipurpose research vessel developed for oceanographic research in coastal seas, on continental shelves and in the blue ocean. R.V Pelagia (built 1991) was specially designed as a multipurpose research vessel. It is a very stable platform and has most favourable nautical properties. She has over 9 years experience in CTD-deployment, biological sampling methods, seismic surveys, coring activities (box-, multi-, piston, gravity, vibro-, CPT) as well as in deployment and recoverage of deep-sea moorings and bottom landers.

Pelagia Around Africa 2000

For the execution of the cruises for the National Programme, R.V. Pelagia was scheduled for a major cruise and made a circumvoyage around Africa combining several other projects during transit and in underway areas in the North and South Atlantic, the Indian Ocean, the Red Sea, and the Eastern Mediterranean. These additional projects were financed by NIOZ and external sources. A report on the scientific projects is given in Chapter 1.

After careful preparations, and being loaded down to her mark, the Pelagia left Texel on 6 January. The "Around Africa 2000" cruise proceeded smoothly right from the start: a start with full headwinds, off Casablanca lightning struck the main mast, leaving a mess of all electronics and crucial navigation instruments. Happily no casualties, and with a few of our electronics'



Small map of the planned cruise track of R.V. Pelagia around Africa 2000. Research programmes are indicated.

wizzards most could be repaired en route. Just after Dakar the engine room ventilator turbine broke down, threatening to transform it into a cooking pot. As no repair was feasible, the extra ventilation of the big hold, where most laboratory vans, cooling and freezing boxes evaporate their heat, was deviated to the engine room, and with a half knot slowing down at the cost of station time, the ship reached Walvis Bay in time. Grumpy noises on the sharp schedule. A new turbine could be manufactured just in time to be flown in and installed, before - within 24 hours - the ship left Walvis Bay, now under cooler climes, and with full speed.

The ship has completed its cruise around Africa safely and on time, including a chase after the tropical cyclone Hudah in the Mosambique strait, a withhold permission by Libyan authorities to serve a mooring deployed a year earlier outside the 12-miles zone, and an escort by the NATO fleet in the Mediterranean. All went well in the end and a press conference was held in Scheveningen on 6 June with a lively attendance.

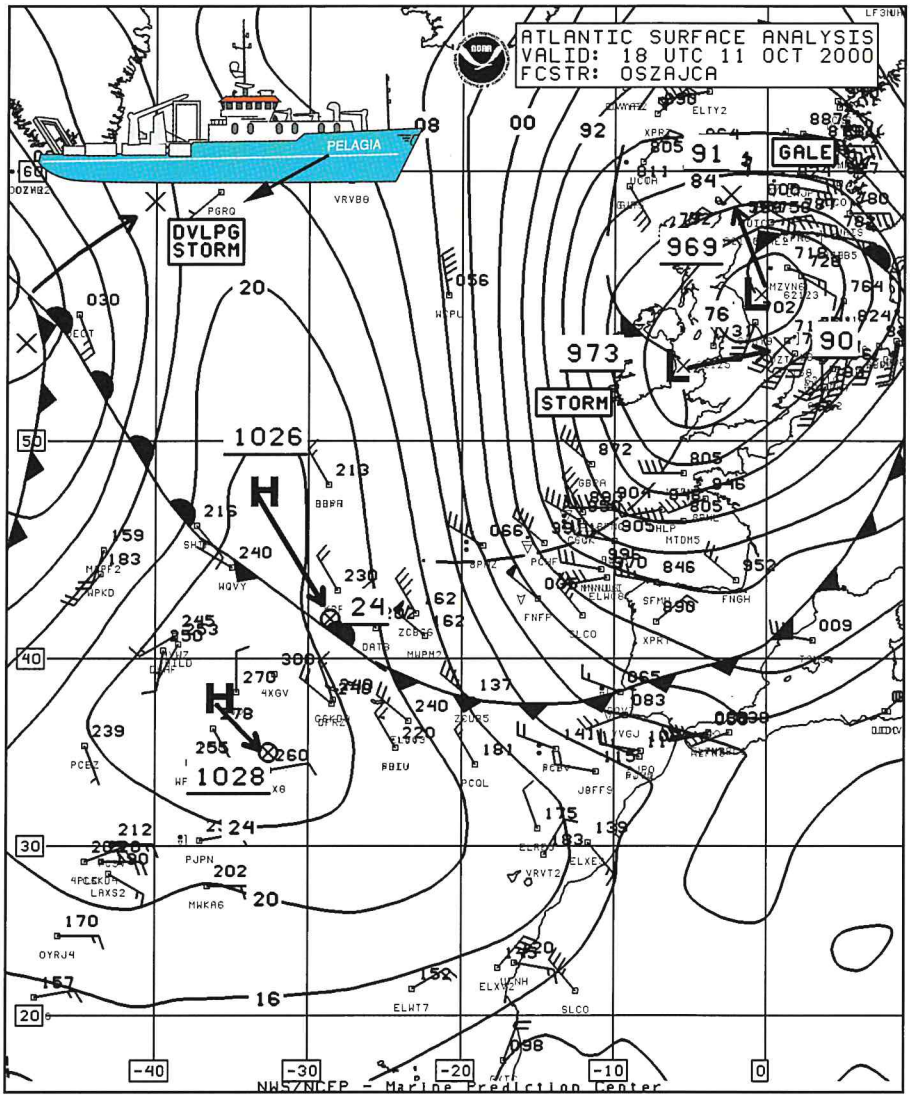
Diplomatic clearance was obtained from Spain, Mauretania, Namibia, South Africa, Mozambique, Madagascar, France, Seychelles, Djibouti, and Italy. Permission was refused by Egypt and Libya. R.V. Pelagia made port-calls at Vigo, Cadiz, Dakar, Walvis Bay, twice at Cape Town, at Port Victoria (Seychelles), Suez, Bari, and Algeçiras before reaching Scheveningen and home port Texel.

RV PELAGIA in Cape Town with Table Mountain in the back ground.
Photo: H. Ridderinkhof.

Much of the success of the performance of the ship and her on and over board equipment can be contributed to the captain and his crew, to the efforts of the on shore assistance and the marine technicians on board, in the ports of call and in the work shops at home, as well as the expedition leaders and their scientific crews. The Pelagia changed crew four times, sailed 20,000 sea miles (over 36,000 km) in 155.5 days, at the cost of 900 ton fuel, and hosted 160 scientific crew of 13 different nationalities.

North Sea and North Atlantic

After the Pelagia Around Africa cruise, starting 11 June R.V. Pelagia executed an extensive research cruise programme of 133 days in the North Sea, and North Atlantic.
To accommodate these cruises diplomatic clearance was obtained from UK, Ireland, and Denmark. A port call for change of crew and scientific party as well as (un)loading scientific equipment took place in Torshavn (Faeroer).



The Voluntary Observing Ships (VOS) programme of the World Meteorologicale Organisation (WMO).

Within the WMO VOS Programme over 7000 ships perform meteorogical records every 6 hours. These records are directly exchanged via the Global Telecommunication System (GTS) for the purpose of weather analysis. These analyses serve as a starting point for the big computer models on which the weather forecasts are based. The national weather services provide the participating ships with the instruments and support.
The Pelagia is a selected ship. 'Selected ships' have a complete set of instruments on board and do additional recordings of for instance wave altitude and swell.
As a research vessel the Pelagia is equiped even better. In co-operation with the KNMI automaticly registrating intruments have been placed on board. Every 12 seconds the air temperature, air pressure, wind speed and wind direction, the relative humidity, global irradiation and water temperature are measured. In addition every 6 hours records are made of wave altitude, swell, type of clouds, etc. Because the quality of the Pelagia records is very good and as the Pelagia often sails in so called 'data sparse areas' (areas with few or no shipping and thus with few of no recordings), her recordings are of great value for the international meteorological world.

The Pelagia on the weather charts

On the weather charts of the meteorological services the data of a number of selected ships are plotted. The Pelagia, with call name **PGRQ**, can be found on the charts of the NOAA for the North Atlantic Ocean.

Maintenance

At the end of the year, after the Pelagia Around Africa cruise and the North Sea and North Atlantic cruises, an advanced docking took place for Pelagia's 10 year Special Survey at the Oranjewerf in Amsterdam. When in dry-dock the opportunity was used for upgrading her technical capabilities for working under tropical conditions. Also other amendments were made, and the container crane was extended for easier handling of container labs. The maintenance took 5 weeks in total.

To end the year a short (6-days) cruise for the National Programme PLUME&BLOOM project took place in December, giving the ship a chance to test at sea her post-docking performance. Just before Christmas the loading could be completed for next year's "Pelagia Around Africa 2001" that started on 3 January 2001.

S.A. AGULHAS

For the execution of the summer cruise of the MARE programme off South Africa, the Antarctic Supply vessel S.A. Agulhas was chartered from the Department of Environment Affairs of the South African Government, because R.V. Pelagia was committed in the North Sea and North Atlantic. Thanks to the assistance of the operator Smit Pentow Marine in Cape Town, and the great efforts of the Marine Technical Service in transforming the ship into a research vessel that was capable of doing the required work, the cruise could be completed successfully.

Deck lay-out and reconstruction was designed by NIOZ, and the reconstruction work was directed on the spot. Eight containers and two winches had to be transported to Cape Town. The reconstruction and making the ship ready to sea complied the fitting of these two winches and five containers with frames and bases, platforms and staircases, the installation of a deck crane from R.V. Africana and a transducer for the deep-sea echo sounder, the fitting of decks and railings for the 25 meter piston core ladder, as well as an auxilliary crane and the rewinding of cables. All these refittings had to be removed after the cruise.

S.A. Agulhas in Cape Town

High Pressure Testing Facility

With the installation of the High Pressure Testing Facility a long wish of the NIOZ Technical Support Services has been fulfilled.

Testing of newly developed equipment can now be done in the NIOZ Workshop itself.

Bringing this heavy load into the institute and making the Testing Facilty operational was quite a job.

Bringing in the HERA (High Pressure Testing) tank through the roof

The High Pressure Testing Facility operational

Photo: B. Aggenbach.

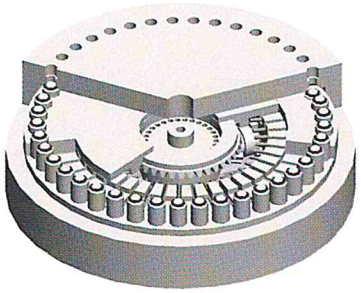
specifications of the High Pressure Testing Facility:

work pressure:	0 – 700 bar
inside diameter:	0.75 meter
inside dephth:	1.80 meter
weight of tank:	approx. 11 ton
weight of lid:	0.9 ton
electrical conductors:	5 pieces
sealing method:	2 O-rings Viton 95
locking system:	4-segmented ring in groove
pump:	air-driven plunjer pump

New developments

Multi-valve closing system for CTD bottles.
For the closure of NOEX bottles of the CTD systems a multi-valve system has been developed.

The old system with the sixty step motor caused too much friction. The new system has 41 plunjer valves that are opened/closed by pins. The system is also less energy consuming.



Titan swivel (20 ton) with ceramic ball-bearings.
This new type of swivel will be used for moorings, deep sea trawling, piston coring, box coring and hoisting activities. Great advantage is: no luboil and corrosion free.

5. Sociaal Jaarverslag

ALGEMEEN

Het grote en ambitieuze vaarprogramma Pelagia Rond Afrika 2000, dat in de eerste vijf maanden van 2000 werd uitgevoerd, vergde veel van de logistieke en technische capaciteit van de Technische Diensten. Het is vooral aan de gezamenlijke inspanning van kapitein en bemanning, walondersteuning, logistiek, technische ondersteuning aan boord, in de havens en in de werkplaatsen, te danken dat deze grote onderneming goed is verlopen en met succes is afgerond. Over deze majeure inspanning is elders in dit jaarverslag meer te lezen.

Ondanks de betrekkelijk ruime financiering van uit competitie verworven gelden uit externe bronnen, bleeft de financiële situatie weinig rooskleurig. Het is moeilijk te verteren, dat tijdens de algemene economische bloei en de steeds toenemende welvaart, onderzoekinstituten onderworpen worden aan een generieke korting. Om aan deze financiële problemen het hoofd te bieden en een structurele oplossing te genereren, heeft het NIOZ een vergaande regeling getroffen, die het mogelijk maakt dat medewerkers op vrijwillige basis vervroegd uit kunnen treden. Tot dusver hebben circa 30 mensen van de NIOZ Regeling gebruik gemaakt. Sleutelposities worden herbezet en de wetenschappelijke capaciteit wordt aangevuld met oio's en postdocs en de technische ondersteuning met jonge medewerkers op tijdelijke contracten.

De algemene bloei in de economie en de gespannen bouwmarkt leidde tot een groeiend probleem bij de uitvoering van de plannen voor de nieuwbouw. De kostenstijging en de als een gevolg daarvan noodzakelijke fasering van de plannen en heronderhandeling met de bouwondernemers over de bouwkosten, heeft tot aanzienlijke vertraging geleid. Alleen de renovatie van het aquariumgebouw was eind 2000 in volle uitvoering.
In 2001 bestaat het NIOZ 125 jaar. De voorbereidingen van een passende viering zijn voortvarend ter hand genomen. Het zal waarschijnlijk ook het jaar worden van de grootste bouwactiviteit.

BESTUUR EN WETENSCHAPCOMMISSIE

Bestuur Stichting NIOZ

Per 31 december 2000 was het bestuur als volgt samengesteld:

Prof.dr. K. Verhoeff, voorzitter	Wageningen
Prof.dr. W. Delden	Vakgroep Genetica, faculteit Biologie, Rijksuniversiteit Groningen
Prof.ir. H.P. van Heel	Veere
Prof.dr. J.E. Meulenkamp	Vakgroep Geologie, Universiteit Utrecht
Prof.dr. Lous van Vloten-Doting	Ministerie LNV
Ir. W. Verhage	Den Haag

Het bestuur kwam in het verslagjaar 2000 vijfmaal met de directie in vergadering bijeen, op 20 januari, 21 maart, 12 juli in Utrecht en Amsterdam en op 9 mei en 10 november te Texel. Op 8 mei en 9 november werd gezamenlijk gedineerd met de Wetenschapcommissie, directie en afdelingshoofden.
Op 10 november werd afscheid genomen van ir. D. Tromp, die in verband met zijn nieuwe functie en de daarmee verbonden vele verplichtingen in het buitenland, zijn bestuurslidmaatschap per 1 september heeft moeten opzeggen. De vergaderingen werden namens de algemeen directeur van NWO bijgewoond door Dr. H. Weijma.
Genotuleerd werd door mevrouw C.S. Blaauboer-de Jong.

Wetenschapcommissie NIOZ

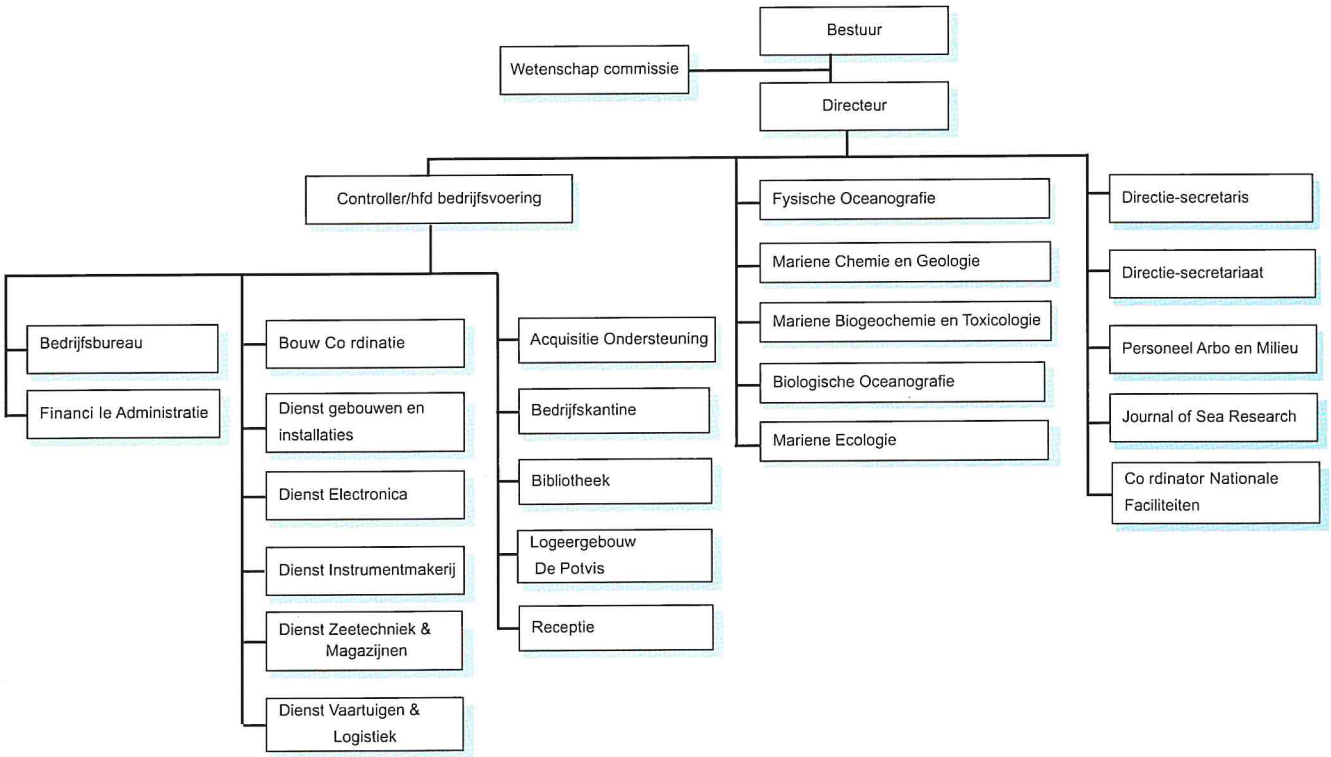
De Wetenschapcommissie NIOZ adviseert het bestuur en de directie over het algemene wetenschappelijk beleid van de Stichting en het Instituut, zij evalueert periodiek het wetenschappelijk programma en zorgt voor de wetenschappelijke beoordelingsprocedure van de voorstellen voor eigen NIOZ-oio's. Van Prof.dr. G. Wefer, wiens termijn dit jaar was afgelopen, werd op 8 mei tijdens het gezamenlijke diner met Bestuur, diverse Commissieleden, Directie en Afdelingshoofden afscheid genomen.

De Wetenschapcommissie was per 31 december 2000 als volgt samengesteld:

Prof.dr. W. van Delden, voorzitter	Vakgroep Genetica, faculteit Biologie Rijksuniversiteit Groningen
Prof.dr. J.P. Henriet	RCMG/Mariene Geologie, Universiteit Gent, België
Prof.dr.ir. G.J.F. van Heijst	Afdeling Technische Natuurkunde, Technische Universiteit Eindhoven
Prof.dr. R.J. Law	Centre for Environment Fisheries and Aquaculture Science (CEFAS), Lowestofft, Engeland
Prof.dr. Karin Lochte	Institut für Ostseeforschung Warnemünde (IOW), Rostock, Warnemünde, Duitsland
Prof.dr. R.M. Warwick	Coastal Marine Biodiversity, Plymouth Marine Laboratory, Plymouth, Engeland

De Wetenschapcommissie kwam in 2000 bijeen op 8-9 mei en 9-10 november te Texel. In mei werd een site visit gehouden bij de afdeling MEE. In november waren de afdelingen MBT en FYS onderwerp van een site visit. Genotuleerd werd door mevrouw C.S. Blaauboer-de Jong.

ORGANOGRAM



PERSONEELSLIJST 31-12-00

DIRECTIE

Leeuw J.W. de Prof. dr.	34.2 uur	directeur	
Rietveld M.J. Drs.		directie-secretaris	
Directiesecretariaat			
Hart-Stam J.M.G.		dir. secretaresse	tot 01-11
Blaauboer-de Jong C.S.	30.4 uur	dir. secretaresse	
Bol-den Heijer A.C.	29.25 uur	dir. secretaresse	
Spel M.M.	13.5 uur	secretaresse	
Markesteijn A.M.		secretaresse	m.i.v. 01-11
Hirschi-de Wit V.L.A.	24 uur	secretaresse	m.i.v. 01-12

STAFEENHEDEN

Personeels-, Arbo en Milieuzaken			
Vooys P.C.		hoofd	
Mulder-Starreveld J.P.	28.5 uur	medewerker	
Financiën en control			
Haas R.G. Drs. ir.		hoofd Bedrijfsvoering/Controller	
Bijsterveld-Kessels A.C.M.		hoofd fin. administratie	tot 01-07
Sombroek J.W.A.		hoofd fin. administratie	m.i.v. 01-08
Arkel M.A. van Drs.		projectcontroller	
Wernand-Godee I.	32.3 uur	medew. project-administratie	
Keijser A.	24 uur	medew. financiële administratie	
Tuinen H.A. van		medew. financiële administratie	
Kooijman-Biermans M.H.M.	28 uur	medew. financiële administratie	
Poleacov-Maraiala C.	32 uur	medew. financiële administratie	m.i.v. 01-10
Graaf A.C. de	30 uur	medewerker	
Porto S.W. de		medewerker Inventarisbeheer	
Nieuwenhuizen J.M.		medewerker Inventarisbeheer	
Ran A.		hoofd Magazijn	
Nationale zeegaande faciliteiten (MRF)			
Bergen Henegouw			
C.N.van Drs. ing.	32.0 uur	coördinator	tot 01-02

CORE PROJECT OFFICE (LOICZ/IGBP)

Crossland C.J. Prof. dr.		executive officer	
Kremer H.H. Dr.		deputy executive officer	
Pattiruhu C. Drs.		office-administrator	tot 01-11
Whyte H.A.Y.		office-administrator	m.i.v. 26-10
Jourdan M.T.	16.0 uur	administratief medewerkster	

WETENSCHAPPELIJKE AFDELINGEN

AFDELING FYSISCHE OCEANOGRAFIE

Ridderinkhof H. Dr ir.		hoofd	
Veth C. Drs.		senior onderzoeker	
Zimmerman J.T.F. Prof. dr.	26.6 uur	senior onderzoeker	
Aken H.M. van Dr.		senior onderzoeker	
Maas L.R.M. Dr.		senior onderzoeker	
Haren J.J.M. van Dr.		senior onderzoeker	
Bruin T.F. de Drs.		datamanager MRF	
Gemmrich J.R. Dr.		projectonderzoeker	tot 01-10
Gerkema T. Dr.		onderzoeker	
Manders A.M.M. Drs.		OIO NWO	
Hosegood P.J.		OIO	m.i.v. 01-03
Volkov D.		OIO	m.i.v. 05-06
Veldhoven A.K. van		OIO	m.i.v. 01-07
Eijgenraam F.		automatiseringsdeskundige	
Nieuwenhuis J.		middelbaar electronicus	
Wernand M.R.	36 uur	senior onderzoekmedewerker	

Ober S. Ing.		senior onderzoekmedewerker
Hillebrand M.T.J.		senior onderzoekmedewerker
Manuels M.W.		onderzoekmedewerker
Hiehle M.A.		senior laboratoriummedewerker
Koster R.X. de		systeemanalist
Regeling G.M.		projectmedewerker	m.i.v. 01-08

AFDELING MARIENE CHEMIE EN GEOLOGIE

Helder W. Dr.		hoofd	
Raaphorst W. van Dr. ir.		senior onderzoeker	
Baar H.J.W. de Prof. dr. ir.	30.4 uur	senior onderzoeker	
Weering T.C.E. van Dr.		senior onderzoeker	
Jansen J.H.F. Dr.		senior onderzoeker	
Brummer G.J.A. Dr.		onderzoeker	
Timmermans K.R. Dr.		onderzoeker	
Stigter H.C. de Drs.	30.0 uur	projectonderzoeker	
Stoll M.H.C. Dr.		postdoc	
Haas H. de Dr.		Projectonderzoeker	
Gaast S.J. van der		senior onderzoekmedewerker	
Vaars A.J.		applicatietechnicus	
Nolting R.F.		senior onderzoekmedewerker	
Kloosterhuis H.T.		senior onderzoekmedewerker	
Ooijen J.C. van		senior onderzoekmedewerker	
Bakker K.M.J.		onderzoekmedewerker	
Malschaert H. Ing.		onderzoekmedewerker	tot 01-12
Boer W. Ing.		onderzoekmedewerker	
Iperen J. van	8.0 uur	senior laboratoriummedewerker	
Kalf J.		senior laboratoriummedewerker	
Witte A.J.M.	19.0 uur	laboratoriummedewerker	
Epping H.G. Dr.		postdoc	
Koning F.A. Drs.	34.2 uur	onderzoeker	
Jong J.T.M. de Ing.		projectassistent NWO/GOA	tot 01-05
Grutters M.C.H. Drs.		OIO	
West S. Drs.		OIO	
Loncaric N. Drs.		OIO	
Bonnin J. Drs.		OIO	
Bozec Y.		OIO	m.i.v. 23-10
			tot 23-12
Thomas H. Dr.		postdoc	
Richter T.O. Dr.		postdoc	
Schefuss E.		OIO NWO	
Croot P.L. Dr.		postdoc	
Laan P.		laboratoriummedewerker	
Gerringa A.L. Dr.	19.0 uur	postdoc	
Peeters F.J.C. Dr.		postdoc	m.i.v. 01-04
Wagt B. van der		laboratoriummedewerker	m.i.v. 01-04
Zee C. van der	OIO-NWO		
Boye M.		onderzoeker	

AFDELING MARIENE BIOGEOCHEMIE EN TOXICOLOGIE

Boon J.P. Dr.		hoofd	
Everaarts J.M. Dr.		senior onderzoeker	tot 01-06
Sinninghe Damsté J.S. Dr. ir.	34.2 uur	senior onderzoeker	
Booy K. Dr.	32.0 uur	onderzoeker	
Versteegh G.J.M. Dr.		onderzoeker	
Schanke A. van Ir.	32.0 uur	OIO	tot 01-05
Blokker P. Drs.		OIO NWO	
Meer van der M.T.J. Drs.		OIO NASA	
Dongen B.E. van Drs.		OIO	
Smittenberg R.H. Ir.		OIO NWO	
Baas M.		onderzoekmedewerker	
Rijpstra W.I.C.	19.0 uur	onderzoekmedewerker	

Lewis W.E.	23.0 uur	senior laboratoriummedewerker	
Weerlee E.M. van		laboratoriummedewerker	
Fischer C.V. Drs.	28.0 uur	laboratoriummedewerker	
Kinkel H.		projectonderzoeker	
Schouten S. Dr. ir.		projectonderzoeker	
Zegers B.N. Dr.		postdoc	
Hopmans E.C. Dr.		postdoc	
Kienhuis M.V.M.		analist	
Werne J.P. Dr.		postdoc	m.i.v. 01-03
Bommel R. van		laboratoriummedewerker	m.i.v. 08-05
Coolen M.J.L. Dr.		postdoc	m.i.v. 15-08
Forster A. Dr.		postdoc	m.i.v. 01-09
Panoto F.E.		laboratoriummedewerker	m.i.v. 01-04
Rampen S.W.		laboratoriummedewerker	m.i.v. 15-05

AFDELING BIOLOGISCHE OCEANOGRAFIE

Herndl G.J. Dr.		hoofd	
Ruardij P. Drs.		onderzoeker	
Fransz H.G. Dr. ir.		senior onderzoeker	
Baars M.A. Dr.		senior onderzoeker	
Klein Breteler W.C.M. Dr.		senior onderzoeker	
Veldhuis M.J.W. Dr.		senior onderzoeker	
Duyl F.C. van Dr.		senior onderzoeker	
Riegman R. Dr.		senior onderzoeker	
Kuipers B.R. Dr.		onderzoeker	
Kraay G.W.		senior onderzoekmedewerker	
Kop A.J. Ing.		onderzoekmedewerker	
Oosterhuis S.S.		onderzoekmedewerker	
Noordeloos A.A.M. Ing.		senior laboratoriummedewerker	
Noort G.J. van		senior laboratoriummedewerker	
Gonzalez S.R.		senior laboratoriummedewerker	
Witte H.J.		senior laboratoriummedewerker	
Schogt N.	30.4 uur	laboratoriummedewerker	
Muyzer G. Dr.		hoofd moleculair lab.	
Stoderegger K.E.		projectonderzoeker	tot 01-12
Pausz C.		projectonderzoeker	tot 01-04
Bleijswijk J.D.L. van Dr.	22.8 uur	onderzoeker m.i.v. 15-05	
Moeseneder M.M.	20 uur	laboratoriummedewerker	tot 01-12
Obernosterer I.B.	20 uur	laboratoriummedewerker	tot 31-12
Kramer G.D.		OIO-NWO	
Dutz J. Dr.		postdoc	
Brussaard C.P.D. Dr.		postdoc	m.i.v. 01-04
Reinthaler T.		OIO	m.i.v. 05-10
Abbas B.A.		laboratoriummedewerker	m.i.v. 01-05
Weinbauer M.G. Dr.		postdoc	m.i.v. 01-04

AFDELING MARIENE ECOLOGIE

Lindeboom H.J. Dr.		hoofd	tot 01-10
Meer J. van der Dr.		senior onderzoeker	
Bak R.P.M. Prof. dr.		senior onderzoeker	
Spaargaren D.H. Dr.		senior onderzoeker	
Cadée G.C. Dr.		senior onderzoeker	tot 01-04
Veer H.W. van der Dr. ir.		senior onderzoeker	
Piersma T. Dr.	36 uur	senior onderzoeker	
Bergman M.J.N. Ir.		onderzoeker	
Duineveld G.C. Drs.		onderzoeker	
Daan R. Dr.		onderzoeker	
Dekker R. Drs.		onderzoeker	
Philippart C.J.M. Dr.	30.4 uur	projectonderzoeker	
Lavaleye M.S.S. Drs.		projectonderzoeker	m.i.v. 05-05
Witbaard R. Dr.		projectonderzoeker NWO	
Drent J. Drs.		OIO NWO	tot 31-12
Gils J. van Drs.		OIO RUG	

Edelaar W.M.C. Drs.		OIO RUG	
Luttikhuizen P. Ir.		OIO RUG	
Dapper R.		automatiseringsdeskundige	
Berghuis E.M.		senior onderzoekmedewerker	
Nieuwland G.		senior onderzoekmedewerker	
Spaans B. Drs.		senior onderzoekmedewerker	
Hegeman J.		onderzoekmedewerker	
Kok A.		onderzoekmedewerker	
Mulder M.		onderzoekmedewerker	
Witte J.IJ.		onderzoekmedewerker	
Puyl P. van der		laboratoriummedewerker	
Bruin W. de		laboratoriummedewerker	
Zuidewind J.		laboratoriummedewerker	
Dekinga A. Drs. Ing.		project-medewerker NWO	
Koutrik A. van	15.2 uur	laboratoriummedewerker	
Lindstrom A.V.	19.0 uur	onderzoeker	m.i.v. 01-11
Bos O.G. Drs.		OIO NWO	
Weber A. Dr.	30.4 uur	postdoc	
Raaymakers C.E.		analist	tot 31-12
Maier C.		OIO	
Holmes S.P. Dr.	postdoc	m.i.v. 01-03	
Vahl W.K.	OIO RUG	m.i.v. 01-04	
Steenpaal S.E.F. van		laboratoriummedewerker	m.i.v. 01-08
Groenewold S. Dr.		projectonderzoeker	m.i.v. 01-05
Camphuijsen C.J.	21 uur	projectonderzoeker	m.i.v. 01-12
Amaro T.		OIO	m.i.v. 01-09
Cardoso J.		OIO	m.i.v. 01-09
Smallegange I.M.	30.4 uur	OIO	m.i.v. 01-11
Reneerkens J.W.H.	30.4 uur	OIO	m.i.v. 01-10

ONDERSTEUNENDE DIENSTEN

Dienst gebouwen en installaties

Alkema P.R.	35.15 uur	hoofd
Groot S.P.	22.8 uur	med. werktuigbouw
Kuip T.		med. werktuigbouw
Lakeman R.	20.0 uur	med. werktuigbouw
Daalder R.M.		med. houtbewerking
Witte R.J.C.		med. houtbewerking
Brondsema A.		med. energietechniek
Schilling F.J.		bouwcoördinator

Receptie

Kikkert A.	20.0 uur	telefoniste/receptioniste	
Jourdan M.T.	20.0 uur	telefoniste/receptioniste	
Starink J.M.	10.0 uur	telefoniste/receptioniste	
Dapper-Maas M.A.	20.0 uur	telefoniste/receptioniste	m.i.v. 14-08
Berbee-Bossen J.		telefoniste/receptioniste (inval)	

Informatie en Presentatie Centrum

Pool W.G. Dr.		hoofd	
Embsen E.G.M. Ing.		automatiseringsdeskundige	tot 01-12
Aggenbach R.P.D.		eerste medewerker	
Manshanden G.M.	14.2 uur	automatiseringsdeskundige	
Barten-Krijgsman N.	15.2 uur	medewerker	
Hart W.	24.0 uur	medewerker	

Bibliotheek

Post W.		hoofd	m.i.v. 01-11
Bruining-De Porto M.E.	31.5 uur	medewerker	

Redactie

Beukema J.J. Dr.	24.0 uur	hoofdredacteur	tot 01-05
Philippart C.J.M. Dr.	7.6 uur	hoofdredacteur	m.i.v. 15-04
Bak-Gade B.	20.0 uur	assistent redacteur	

Instrumentmaken

Boekel H.J.	hoofd	
Keijzer E.J.H.	medewerker	
Heerwaarden J. van	medewerker	

Electronica

Groenewegen R.L. Ing.	30.4 uur	hoofd
Koster B. Ing.	plv. hoofd	
Franken H. Ing.	hoger electronicus	
Laan M.	hoger electronicus	
Derksen J.D.J.	electronicus Pelagia	
Asjes A.J.	medewerker	

Zeetechniek

Porto H.H. de	hoofd	
Schilling J.	plv. hoofd	
Polman W.	medewerker	
Bakker M.C.	medewerker	
Blom J.J.	medewerker	
Wuis L.M.	medewerker	
Boom L.	medewerker	
Gieles S.J.M.	medewerker	
Wit J.T. de	medewerker	
Stins R.	medewerker	tot 01-03
Grisnich P.W.	medewerker	
Witte Y.	medewerker	m.i.v. 01-12
Bonne E.	medewerker (detachering)	

Vaartuigen en logistiek

Buisman T.C.J.	hoofd	
Souwer A.J.	medewerker	
Groot J.C.	gezagvoerder Pelagia	
Ellen J.C.	1e stuurman Pelagia	
Duyn M.D. van	2e stuurman Pelagia	
Pieterse J.M.	hoofdwerktuigkundige Pelagia	
Seepma J.	1e werktuigkundige Pelagia	
Kalf J.J.	2e werktuigkundige Pelagia	tot 01-05
Saalmink P.W.	scheepstechnicus Pelagia	
Stevens C.T.	scheepstechnicus Pelagia	
Mik G.	scheepskok Pelagia	
Betsema G.L.J.	matroos Pelagia	
Hogeweg M.T.	1e werktuigkundige Pelagia	m.i.v. 20-11
Brandsma J.	2e werktuigkundige Pelagia	m.i.v. 01-12
Slikke R. van der	matroos Pelagia	m.i.v. 06-11
Maas J.J.M.	matroos Pelagia	m.i.v. 06-11
Heide R. van der	matroos Pelagia	m.i.v. 20-11
Adriaans E.J.	schipper Griend	
Star C.J. van der	schipper Navicula	
Tuntelder J.C.	scheepstechnicus/kok Navicula	
Vis van der P.C.A	machinist/motordrijver Navicula	
Jongejan W.P.	komvisser	

ARBEIDSVOORWAARDEN

Collectieve Arbeidsovereenskomst

Per 1 maart 2000 is de tweede Collectieve Arbeidsovereenkomst voor de Onderzoekinstellingen (CAO-OI) in werking getreden. Deze CAO is aangegaan voor de periode van 1 maart 2000 tot 1 maart 2001 en voorziet onder meer in een generieke salarisverhoging van 3,5% per 1 maart 2000. Tevens zijn per 1 juli 2000 de zogenaamde wachtjaren in de salarisschalen 1 t/m 5 vervallen.

Arbeidsvoorwaarden op maat

In het verslagjaar is door de WVOI (*) een studie verricht naar de mogelijkheid om per 1 januari 2001 een pakket arbeidsvoorwaarden open te stellen waarvan de individuele medewerker, gericht op zijn eigen wensen, op vrijwillige basis gebruik kan maken. Het betreft derhalve een extra voorziening die naast het CAO-standaardpakket kan worden aangewend.

Als uitgangspunt hierbij geldt dat de medewerker tegen inlevering van de bronnen vakantie-uren en bruto salaris een uitbreiding van zijn arbeidsvoorwaardenpakket kan realiseren (de zogenaamde doelen: tijd en geld, kinderopvang, PC-privé, reiskosten woon-werkverkeer/fiets privé e.d.).

Bij de inventarisatie van de wensen bestond vooral belangstelling voor de aanschaf van een PC. Een enkeling opteerde voor het doel fiets privé en voor extra verlof.

Vanwege de financiële situatie waarin het NIOZ verkeert is het voor NIOZ-medewerkers niet mogelijk om voor het jaar 2001 de bron vakantie-uren in te zetten, voor bijvoorbeeld de aanschaf van een PC. Deze uitsluiting geldt eveneens voor het doel geld (bijvoorbeeld: verkopen van vakantie-uren). In de loop van het jaar 2001 zal besloten worden of deze uitsluiting voor het volgende jaar tevens zal gelden.

* De WVOI bestaat uit de Koninklijke Bibliotheek (KB), het Rijksinstituut voor Oorlogsdocumentatie (RIOD), de Koninklijke Nederlandse Academie voor Wetenschappen (KNAW) en de Nederlandse organisatie voor Wetenschappelijk Onderzoek (NWO) waarin vertegenwoordigd o.a. het NIOZ.

Regeling NIOZ

Per 1 september 2000 is na overleg met en met goedkeuring van het Algemeen Bestuur van NWO de "regeling NIOZ" in werking getreden. Voornoemde regeling beoogt een substantiële en structurele vermindering van de salariskosten van de vaste personeelsformatie. De regeling biedt aan medewerkers vanaf de leeftijd 55 jaar de mogelijkheid om op vrijwillige basis volledig te stoppen met werken tegen behoud van 75% van de bezoldiging.

Voorwaarde om van deze regeling gebruik te maken is dat men op de leeftijd 61 respectievelijk 62 jaar overstapt naar de regeling Flexibel Pensioen en Uittreden (FPU). Tevens kent de regeling, onder zekere voorwaarden, een beperkt aantal andere mogelijkheden op grond waarvan tot een detachering bij een andere werkgever of een volledige verbreking van het dienstverband kan worden overgegaan.

Teneinde de medewerkers de gelegenheid te bieden een weloverwogen besluit te nemen is de regeling tot 1 januari 2001 opengesteld. Circa 30 medewerkers hebben op enigerlei wijze van de regeling gebruik gemaakt of zullen dat de komende jaren doen.

Individueel Klachtrecht

De Uitvoeringsregeling Individueel Klachtrecht biedt werknemers de mogelijkheid om klachten, over een gedraging door of vanwege de werkgever bespreekbaar te maken en te doen onderzoeken.

In 2000 heeft de Klachtadviescommissie één klacht in behandeling genomen.

ARBO- EN MILIEUJAARVERSLAG NIOZ 2000

Inleiding

In dit verslag wordt gerapporteerd over de belangrijkste activiteiten op het terrein van arbo en milieu die in 2000 hebben plaatsgevonden. Omwille van de leesbaarheid is de rapportage zo beknopt mogelijk gehouden.

1. Beleid
Het NIOZ is doorgegaan met het opzetten van een integraal management systeem. In verband met internationale afspraken in eerste instantie voor de dienst vaartuigen. Het systeem zal stapsgewijs worden uitgebreid.

2. Personeel
Arbo- en milieuzaken werden besproken in de overlegvergaderingen van directie met de OR, van directie met de kleine staf en in de Arbo- en Milieucommissie.

3. Ongevallen
Als gevolg van een val van een vaste trap aan boord van de Pelagia op de Indische Oceaan op 9 april heeft een opvarende per direct ernstige enkelzijdige rugklachten opgelopen, die continue pijnmedicatie noodzakelijk maakten. Röntgendiagnostiek toonde aan dat er sprake was van een breuk van twee lendewerveluitsteeksels.

Bij het afvoeren van verpakkingsmateriaal in de laatste week van september stootte een medewerker met het deksel van een grote kist tegen een van de houten bakken van het plafond. Deze bak raakte los en kwam op zijn hoofd terecht. Na een bezoek aan de huisarts bleek dat hij verder geen letsel had opgelopen aan zijn nek. Wel kreeg hij die dag rugpijn waarschijnlijk veroorzaakt door, wat later bleek, een uitgestulpte tussenwervelschijf van de onderste wervel. De ophanging van alle bakken is gecontroleerd.

4. Veiligheids- en milieuzaken
De tussen 1995 en 1998 uitgevoerde risico inventarisaties en evaluaties zijn door Avios arbo in december 1998 getoetst. Rapportage over deze toetsing kwam beschikbaar in mei 1999. Goedkeuring van de RIE werd verleend onder enkele voorwaarden. Om aan de voorwaarden te voldoen werd een Plan van Aanpak opgesteld. Prioriteiten zijn in dat plan aangegeven.

Ten behoeve van de door Rijkswaterstaat verleende lozingsvergunning zijn elk kwartaal analyses gedaan van het afvalwater van het aquariumgebouw en de laboratoria.

Via de gehuurde container is door de firma Watco EcoService (voorheen Ecotechniek) 1025 kg klein gevaarlijk afval afgevoerd; dit was in 1993 805 kg, in 1994 2155 kg, in 1995 1395 kg, in 1996 2295 kg, in 1997 1345 kg, in 1998 3147 kg en in 1999 2487 kg. De belangrijkste componenten waren oplosmiddelen, giftige chemicaliën, laboratoriumafval, batterijen en TL buizen.

Overzicht papierverbruik in vellen A4.

Jaar	Totaal	Kopieermachines	Overige
1990	746.567	736.567	10.000
1991	1.034.654	886.654	148.000
1992	1.279.539	993.539	286.000
1993	1.391.614	967.614	424.000
1994	1.686.015	1.124.015	562.000
1995	1.696.993	996.993	700.000
1996	1.172.000	774.175	397.825
1997	1.261.000	814.741	446.259
1998	1.170.500	727.256	443.244
1999	1.205.000	709.698	495.302
2000	1.216.000	640.609	575.391

Overzicht energieverbruik en energiekosten

Jaar	kWh	m^3 gas	m^3 water	Energiekosten
1991	1.406.820	300.707	15.500	404.437
1992	1.729.800	278.716		454.748
1993	1.991.180	307.489		481.909
1994	2.082.247	479.480	16.716	443.122
1995	1.285.740	422.477	15.923	417.168
1996	1.147.907	562.329	13.599	462.221
1997	1.212.420	491.194	12.380	452.186
1998	1.143.423	506.155	11.952	473.694
1999	1.304.540	471.621	11.252	482.627
2000	1.253.334	499.147	14.328	602.682

Door de warmte-kracht installatie (WKK) is behalve warmte ook 758.415 kWh electriciteit geleverd.

Door de windmolen is nog extra 111.265 kWh voor NIOZ gebruik opgewekt.

5. Bedrijfsgezondheidszorg

Vier leden van de brandweerploeg werden gekeurd en geschikt verklaard.

Ziekteverzuim

In het jaar 2000 is het ziekteverzuim ten opzichte van 1999 lichtelijk gestegen. (6.8% tegen 5.5%). Dit wordt voornamelijk veroorzaakt door een toename van het zwangerschaps- en bevallingsverlof in de categorie niet wetenschappelijk personeel en door een beperkt aantal langdurig zieken in dezelfde categorie.

	WP	M	V	NWP	M	V
1999	5.5	5.4	5.8	5.5	5.5	5.1
2000	5.6	5.8	4.9	8.6	6.9	15.6

Volledigheidshalve wordt opgemerkt dat de verzuimpercentages uitsluitend betrekking hebben op het kalenderjaar 2000.

6. Bedrijfshulpverlening

Ten behoeve van de EHBO voorziening zijn vijftien personen op herhaling-cursus geweest voor het eenheidsdiploma EHBO van het Oranje Kruis. De cursus werd gegeven door Den Helder Training Centre.

De leden van de bedrijfsbrandweer oefenden maandelijks 2 uur.
De jaarlijkse controle van de brandmeldinstallatie en alle brandmelders is verricht evenals de controle van de kleine blusmiddelen en de zes adembeschermingsapparaten van de brandweerploeg.

7. Investeringen

Door de financiële situatie waarin het instituut verkeert, is door de afdelingen en diensten geen geld begroot voor de verbetering van de werkplek. Incidenteel zijn enkele maatregelen genomen.

8. Vergunningen

In verband met de vergunning voor het lozen van afvalwater op de Waddenzee heeft het laboratorium van Tauw Milieu te Deventer ieder kwartaal het geloosde afvalwater geanalyseerd op de onderstaande parameters volgens de vermelde methode:

Omschrijving	Methode	Maximum grens	1e kwartaal 2000	2e kwartaal 2000	3e kwartaal 2000	4e kwartaal 2000
Ontsluiting	NEN 6465					
Cadmium	NEN 6452	0,005 mg/l	<0,004	<0,0002	<0,002	0,0003
Kwik	NEN 1483	0,0003 mg/l	<0,0001	<0,0002	<0,001	<0,001
Arseen	NEN 6457	0,005 mg/l	0,001	0,001	0,0015	0,0035
Zink	NEN 6426	0,2 mg/l	0,022	0,070	0,020	<0,040
Chroom	NEN 6426	0,2 mg/l	<0,002	0,022	<0,002	<0,020
Nikkel	NEN 6426	0,2 mg/l	<0,002	0,018	<0,002	<0,020
Koper	NEN 6426	0,2 mg/l	<0,004	0,028	0,010	<0,040
Lood	NEN 6426	0,2 mg/l	<0,010	<0,010	<0,010	<0,100
Molybdeen	NEN 6426	0,2 mg/l	0,017	0,040	0,038	0,070
Zilver	NEN 6426	0,2 mg/l	<0,004	<0,004	<0,004	<0,040
EOX	NEN 6676	0,1 mg/l	0,002	0,002	<0,001	<0,001
Som van MAK	o-NEN 6407	0,1 mg/l	<0,0018	<0,002	<0,0018	<0,004
pH	NEN 6411	6<pH<9	8,1	7,8	7,8	7,9
Chloride	NEN 6476	mg/l	13000	12200	14300	13400
Geloosde hoeveelheid		m^3	19.600	17.880	19.000	18.720

Het NIOZ heeft opgave gedaan van de geloosde hoeveelheid zeewater en laboratoriumafvalwater in m3/kwartaal. Voor een beter inzicht in de aard van het water is een chloride bepaling gedaan als aanvulling op de vereiste metingen.

Deze gegevens zijn uiterlijk één maand na het beeindigen van ieder kwartaal toegezonden aan Rijkswaterstaat Directie Noord Holland met afschrift aan het RIZA.

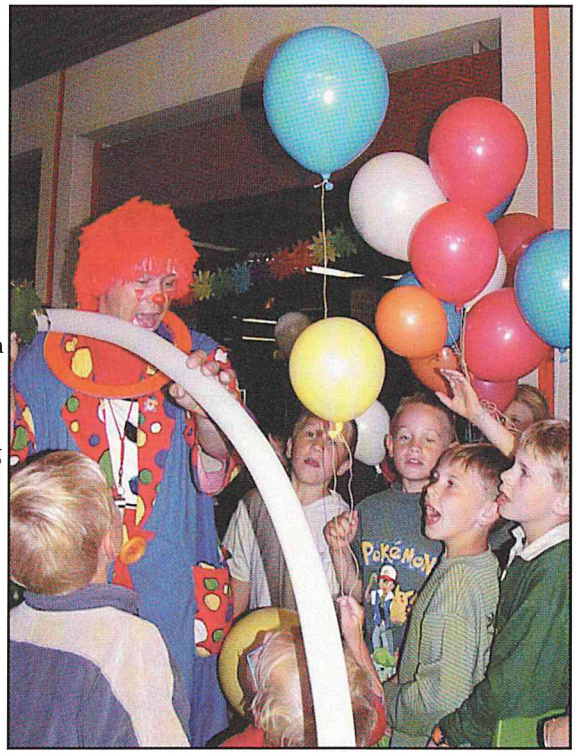
VERSLAG VAN DE PERSONEELSVERENIGING

Met de eeuwwisseling nog vers in het geheugen gingen wij, het pv-bestuur, weer aan de slag om voor enig vermaak te zorgen.

In mei werd het weer tijd om voor de kinderen van het NIOZ-personeel het kinderpannenkoekenfeest te organiseren. Hiervoor hadden we de medewerking in geroepen van clown Max, die er met enig goochelwerk en balonnen vouwen er een geslaagde middag van wist te maken.

In oktober leek het ons idee voor weer eens een sportieve bezigheid, onder de naam "Hole in one, two, three....." wat voor menig deelnemer zeker het geval was, werden de thermen "putting green", "driving range", "chippen", "putten", maar vooral de "swing" ons eigen gemaakt. Na dit onder de knie te hebben werd het tijd om de oefenbaan '9 holes-par 3' van de golfbaan 'de texelse' te betreden.

Ter afsluiting van dit sportieve onderonsje was er in 't Hanenhuus tijd voor een borrel, een hapje, maar vooral (weer) sterke verhalen.



Ook dit jaar weer een knallende afsluiting van het jaar. Op 21 december was de loods bij de afdeling zeetechniek weer omgetoverd tot feestzaal en als zodanig gebruikt. Op naar het "jubel-jaar 2001" waarin het NIOZ 125 jaar bestaat en wij als pv-bestuur ons steentje zullen bijdragen.